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vol 9 # 108

December 1955

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Editor: GEORGE SELL

Vol. 9, No. 108 **December 1955**

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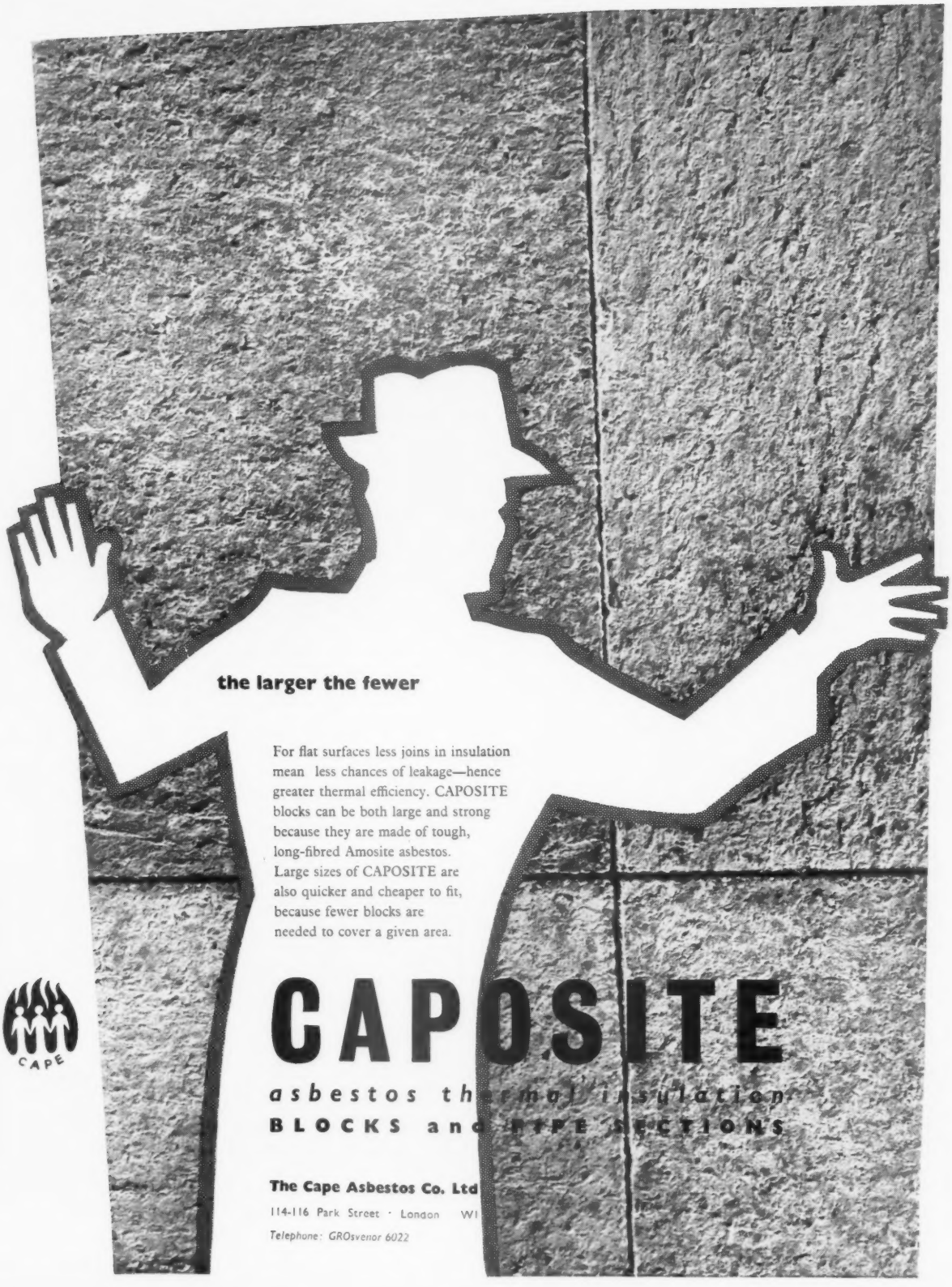

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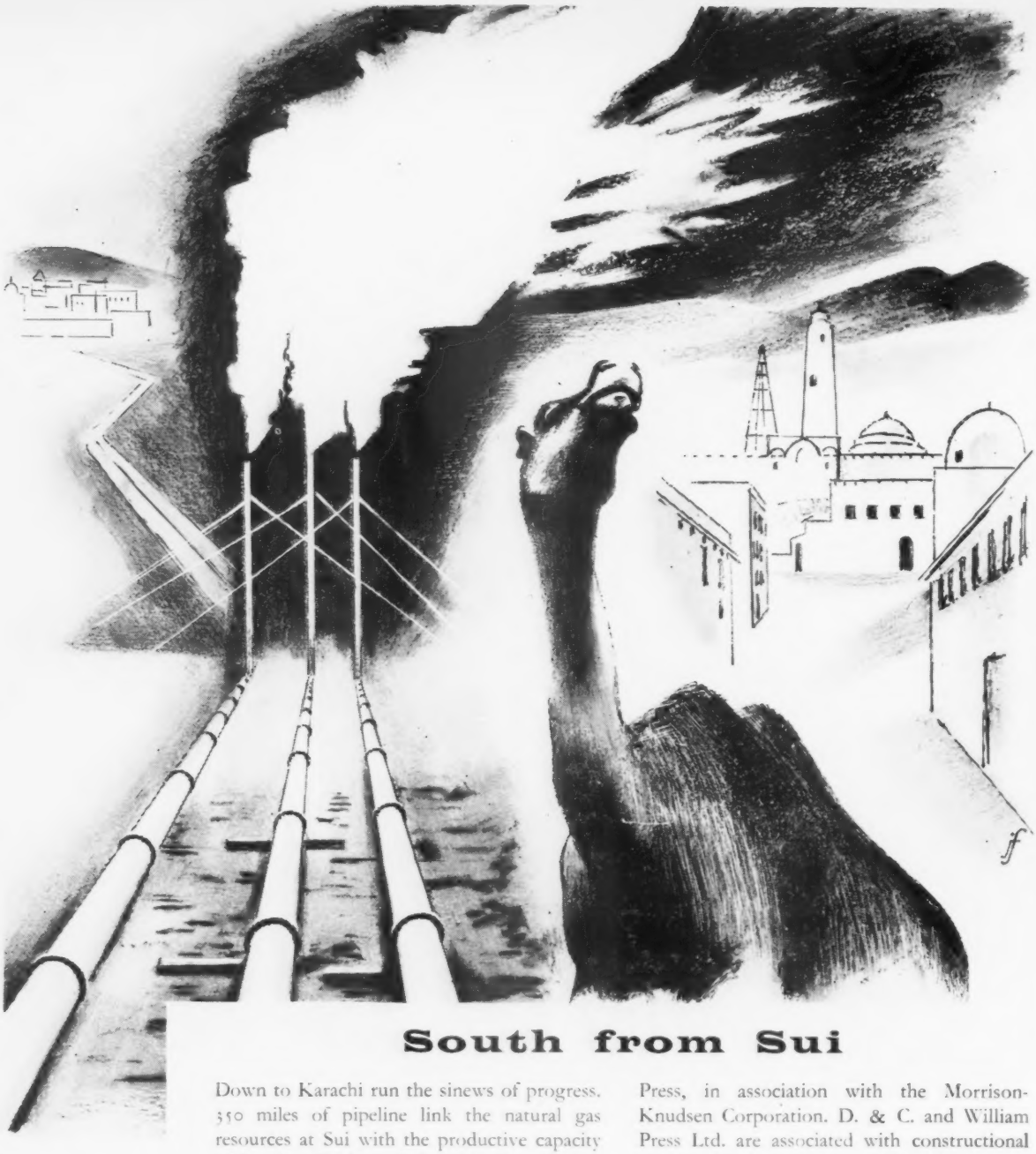

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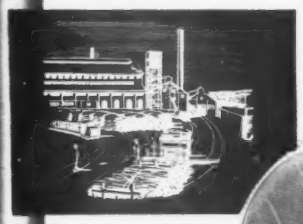

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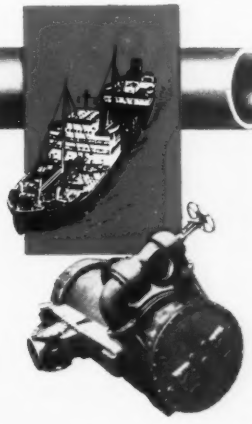

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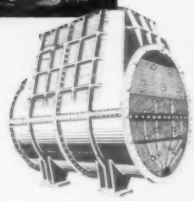

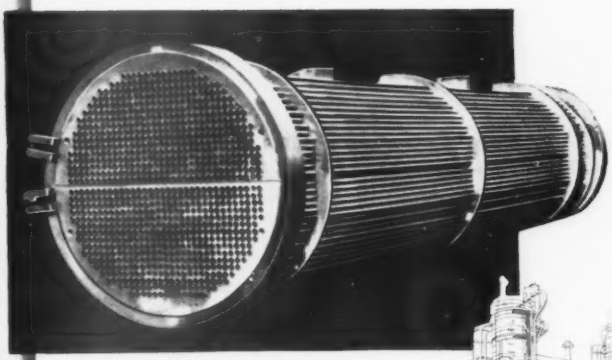

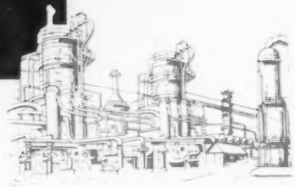

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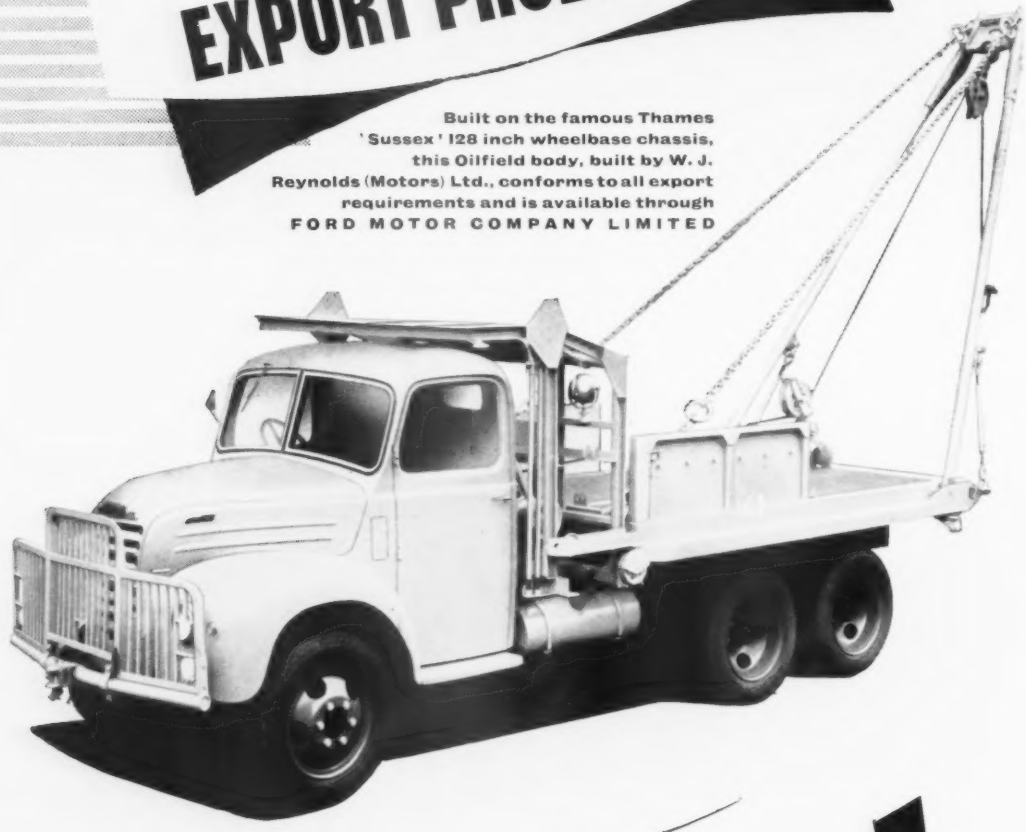

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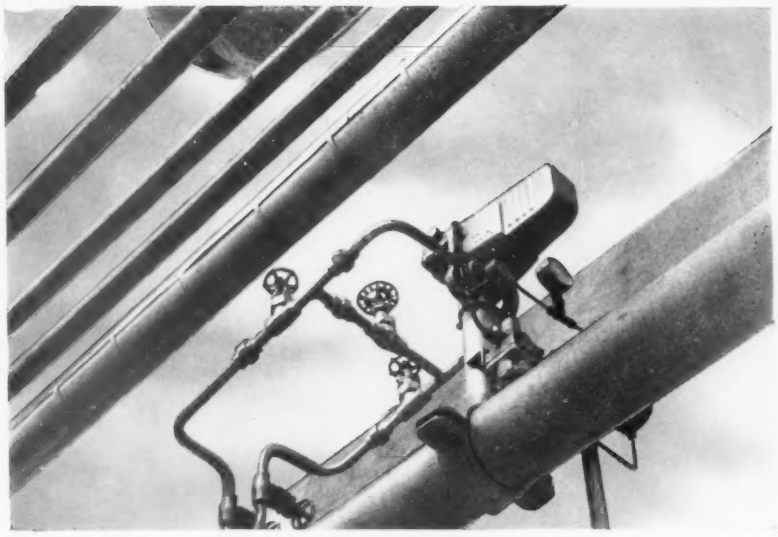

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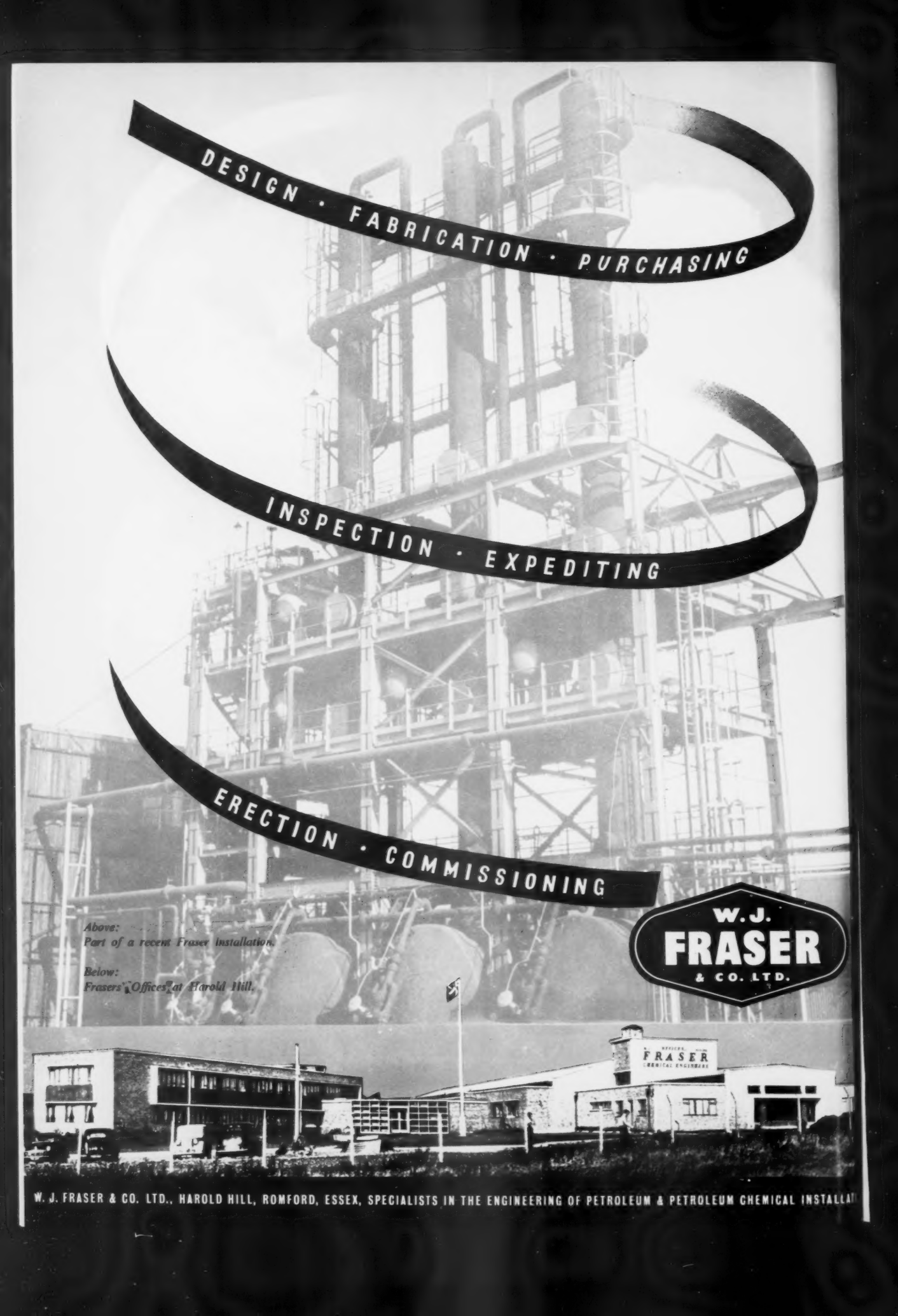

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John A. Oriel receiving the Eastlake Medal from Dr E. B. Evans.

Presentation of IP Awards

Eastlake Medal

and

Honorary Fellowship

On 12 October 1955 members of the Institute of Petroleum gathered in the lecture hall at 26 Portland Place to witness the presentation of two awards for meritorious service to the Institute. The first was the Eastlake Medal, awarded to John A. Oriel, C.B.E., M.C., and the second, the Honorary Fellowship of the Institute, awarded to Sir Frank E. Smith, G.C.B., G.B.E.

The presentations were made by Dr E. B. Evans, a Vice-President of the Institute, who first expressed the regrets of the President that a visit to the United States made it impossible for him to be present.

The Eastlake Medal

Making the presentation of the Eastlake Medal, Dr Evans said: "Mr Oriel has had an extremely distinguished career in the petroleum industry, besides being a very old friend of many of us. He joined the industry in 1921 and has served in Egypt, in Holland and in the U.K., ultimately becoming general manager of "Shell" Refining and Marketing Company and chief chemist of The Shell Petroleum Co Ltd. Today he acts as consultant to the personnel administration of the Shell Group. He has done a great deal of work both for the country and for the industry, and during the last war he was active in the initiation and progressing of many important projects, in recognition of which he was awarded the C.B.E. in 1946.

"Mr Oriel joined the Institute in 1933 and first became a member of the Council in 1940. Since then he has served on many of the committees of the Institute and is Chairman of the Education Committee. He was a Vice-President from 1943-8 and has held that office again since 1953. He has done an immense amount of work behind the scenes and is one of our most active and distinguished members.

"The Eastlake Medal is awarded for long and meritorious service to the Institute by one of its members. It commemorates Arthur W. Eastlake, a co-founder of the Institute who served as Honorary Secretary for more than thirty years. It is very fitting, therefore, that a medal should be awarded to mark similar service by members of the Institute, and particularly fitting that this year's presentation should be made to Mr Oriel, who has done so much work for us. We can congratulate ourselves on our second recipient of this very important medal."

Mr John A. Oriel then accepted the Eastlake Medal from Dr Evans amid prolonged applause, and signed the Book of Honour.

John A. Oriel, after receiving the Medal said: "I want to thank you, Dr Evans, very much indeed for the kind words you have said about me and for presenting me with the Eastlake Medal. It brings a very warm feeling to the heart to be recognized in this way, however undeserved, after thirty-five years in an industry of which I am sure we are all proud to be members. I think that if it may be said of a great number of us of my vintage that we have devoted our lives to it, we would say it in the same way as an artist would say that he has devoted his life to art. It is a wonderful industry, it is one that is always forward-looking and full of interest. I have enjoyed every minute in it, and am proud to be a member of it. I am sure we are all proud when we can tell our friends and relations that we are oil men.

Thank you again very much for what you have said and the Institute for granting me this honour.

The Honorary Fellowship

Dr E. B. Evans, presenting the Honorary Fellowship, said: "The second pleasant duty I have to perform is the award of the Honorary Fellowship of the Institute to Sir Frank E. Smith. Sir Frank has had a varied and an amazing career in both the scientific and the administrative fields. His early work started at the National Physical Laboratory and was concerned with electrical science. Following that he became the first director of research to the Admiralty and a little later

At the IP Council Dinner after the meeting—W. S. Thompson, Oliver Thompson, J. A. Oriel, D. L. Samuel, E. J. Sturgess, F. L. Garton, H. Hyams.

Secretary to the Department of Scientific and Industrial Research. Later on, in about 1938, he formed his first direct connexion with the oil industry, becoming scientific adviser to the then Anglo-Iranian Oil Company. During the war he was controller of telecommunications equipment for the Ministry of Aircraft Production and Chairman of the Scientific Advisory Board of the Ministry of Supply. These things alone are sufficient to constitute a career for most people, but Sir Frank also found time to do much else. For about nine years he was Secretary of the Royal Society, for about an equal period of time he was Honorary Secretary of the British Association; he has been President of the Institute of Physics, President of the Physical Society, and has engaged in many other activities both in connexion with scientific societies and with Government and official bodies.

"His scientific achievements were recognized by his election to the Royal Society in 1918. He was knighted in 1931 and further honoured for his war and other services by promotion to the rank of Knight Grand Cross both of the Order of the Bath and a little later of the British Empire. His record of achievement is one of the most remarkable of any scientific man in Britain today.

"His association with the oil industry began in one sense with his connexion with the Anglo-Iranian Oil Company, but he had, of course, considerable knowledge of and contact with the industry during his period as Secretary of the Department of Scientific and Industrial Research. He was also at one time Chairman of the Road Research Board, which again is an organization which has considerable connexion with the petroleum industry.

"He has always been extremely helpful to the Institute and on many occasions we have had the benefit of his advice and assistance in matters of a very varied character.

"The Honorary Fellowship of the Institute has previously been awarded only nine times and I do not think we could find a more distinguished recipient of this award than Sir Frank Smith."

Sir Frank Smith then accepted the Honorary Fellowship, amid applause, and said: "I appreciate very much the honour which you have conferred on me and accept it with very great pleasure. As the Chairman has said, my interest in life has been in research. I have been concerned with it, mainly industrial research, for over fifty years. Sixteen of these years have been spent in the petroleum industry and I have had great enjoyment and made very many friends in those years.

"My first contact with the Institute was when Professor J. S. S. Brame, who was then President, invited me to an Annual Dinner. Sir Thomas Holland, another President, also invited me as his guest to an Annual Dinner, but it was Sir John Cadman, as he then was, who really persuaded me to join the Institute. It is a very fine Institute indeed, stimulating as it does, by publication of papers and by discussions, workers in research, petroleum and other engineers, and those interested in many other branches of science and technology.

"Petroleum is one of our most valuable liquids and yet we know very little about it. We neglect consideration of those electro-magnetic forces which cause atoms to join together to form chains and rings. Attention is, however, now being given to some of these problems and experiments on the bombardment of petroleum hydrocarbons with high-speed particles may open a new and revolutionary chapter in the history of petroleum.

"Mr Chairman and gentlemen, again I thank you."

★ ★ ★

ASTM MEETINGS 1956-8

The ASTM announce that the following dates have been arranged for their national meetings.

1956: Committee Week. 27 Feb-2 March, Hotel Statler, Buffalo, New York.
59th Annual Meeting and 12th Apparatus Exhibition. 17-22 June, Chalfonte-Haddon Hall, Atlantic City, New Jersey.
2nd Pacific Area National Meeting and Apparatus Exhibition. 16-22 Sept, Hotel Statler, Los Angeles, California.

1957: Committee Week. 4-8 Feb, Benjamin Franklin Hotel, Philadelphia, Pennsylvania.
60th Annual Meeting. 16-21 June, Chalfonte-Haddon Hall, Atlantic City, New Jersey.

1958: Committee Week. 9-15 Feb, Hotel Statler, St. Louis, Missouri.
61st Annual Meeting. 22-28 June, Hotel Statler, Boston, Massachusetts.

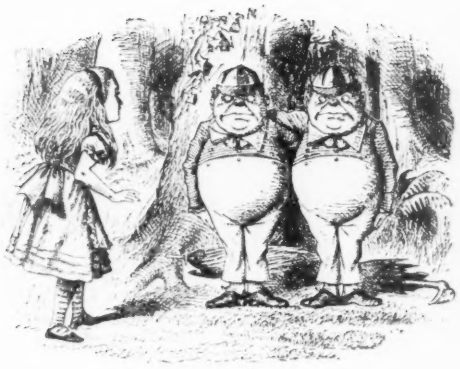
Interested visitors are always welcome at the Society's annual and district meetings.

(Left) *Sir Frank Smith receives the Honorary Fellowship from Dr E. B. Evans and* (right) *with T. Dewhurst and H. S. Gibson, past-presidents.*

Tweedledum

v.

Tweedledee



(or How Not to Find Oil)

By JABBERWOCK

The non-scientific members of some of our oil companies must have been puzzled many times by such statements as—"The Palaeozoic-Mesozoic-Tertiary basins (paraliogeosynclines) suggest a thalasso-cratonic structure which is differentiated by exothermic chemical and mechanical equilibriopetal processes" and "It is suggested that a detailed reversed line should be shot with 2nd break technique, using Grasschicks' interpretational method of smoothing topo features".

The context usually assists in showing that the first piece of jargon is written by a geologist and the second is the special magic of the geophysicist. Both are in this instance using that method so successfully operated by members of the medical profession, of baffling the layman. While there may be some sense in hiding from the patient the extent of his bodily derangements, on the grounds that faith is a great healer, there does not seem to be much point in confusing the executive who has to lay down the money required to drill an exploratory borehole. Of all the sciences, geological and geophysical prospecting are probably the easiest to explain to non-scientific listeners, because the principles of geology are simple and straightforward, and examples of what can happen to rocks underground are often laid bare on the surface for even the humblest eye to inspect. In the 19th century geology was the hobby of schoolmasters and parsons, and a gentlemanly hobby it was, without the complication of boreholes which were thrust upon the geologist of the oil-age by spoilsports of engineers, or the bag of geophysical tricks produced more recently by the physicist (why couldn't they mind their own business?). Rude economics insist that minerals should be found and that all talents should be applied to do this as expeditiously as possible, but this does not alter the fact that the geological structures that house minerals can be visualized quite readily by any intelligent person, unlike some physical concepts such as, for example, the inside of an atom, which do require some analogy for their understanding by the uninitiated.

Geophysicists make great play with the word "interpretation" which, as generally used, merely means working out their results. In seismic experiments the depths of various geological layers below the surface are measured by timing how long sound waves take to travel down and back. The simple conversion of time into distance is the mystic interpretation process, which ensures that no one without a scientific background, and not even geologists either, shall be allowed to trespass by looking at seismic records for themselves. The geophysical journals carry articles on this or that method of interpretation, which usually are as pertinent to the subject as whether to use logarithms or a slide rule in arithmetic. The sound waves recorded can reveal a certain amount of information and no amount of mathematical juggling will reach any other result than that contained in the measured travel times; any ambiguity must be expressed, or must be removed by making additional observations. British commercial geophysical methods differ from the academic approach to geophysics in that they search only for hidden oil structures. Reading of American literature indicates that in the United States the present trend is to follow the universities and to search for geological information rather than for the structures themselves. This is no doubt because all the large easily-found structures have been located in America, and also because the geologist in the U.S.A. includes geophysics in his training; he has, in fact, accepted geophysical methods as useful tools, just as British geologists have taken over the deep borehole as a useful adjunct to examination of surface features.

Fighting for the Rattle

While the geophysicist can be criticized for looking at structures on his own instead of studying geological formations in general, the geologist is as much to blame because he places the users of well-tried geophysical methods in much the same category as water-diviners. They both may assist in locating the right place to put down a borehole, but it is all done by mumbo-jumbo and black boxes. This far-away-look type of geologist abhors any tedious detail such as plotting the thickness of various rock layers that disappear underground, or putting accurate heights to rock outcrops, and prefers to rely on intuition and simple analogy. He may be heard to state with confidence that he will be prepared to drink all the oil found in such and such an island, and when he calls on the geophysicist he asks for a refraction survey or a magnetic survey as if ordering a pound of tea from a shop. He never thinks of working out a programme of

Tenniel illustration from *Through the Looking Glass* reproduced by courtesy of Macmillan & Co. Ltd.

geophysical work "tailored" to suit the particular problem. The geophysicist does the prospecting on a routine basis with few variants, with little reference to surface outcrops and geological trends, and with no geologist in attendance to propose additional experiments while the party is in the field. The quantity of geophysical results rather than the quality is the main criterion in assessing the performance of a field party; never does one hear praise of a party leader because he found geological information that was subsequently proved correct by drilling. This approach to oil-finding has been notoriously unsuccessful during the past twenty years and the cry of both Tweedledum and Tweedledee is the same, "It's your fault", or maybe, "It's not my fault".

When asked why they do not co-operate, both geologists and geophysicists have two types of reply. Approach one is a flat contradiction, based on the fact that cross-talk does occur at top level. This is only when the contour maps produced from below by both divisions of the exploration department are compared and whittled to make a convincing reason for locating a borehole, the siting of which may well be a compromise lying in a dip between the two rival "highs". Approach two blandly asserts that it is much better to have two independent guesses at the optimum site for a borehole; great confidence is engendered if both locations are in the same place, because the results are independent. Presumably, collaboration at a low level is supposed to lead to making geophysical results fit the geological picture and vice-versa.

That is, to say the least of it, a non-scientific attitude, because from the earliest part of his training a scientist is taught to accept facts honestly and alter his preconceived ideas (which themselves are necessary in order to set out sensible experiments) to embrace as many of the new results as possible. One cannot help but be suspicious of the ability of geologists or geophysicists who wish to work independently of each other. It could well be that they wish to preserve their little "know-hows" intact and inviolable. "I won't show you how I get this result, but there it is, and I believe it. Don't question my faith". (Shades of Billy Graham).

The watertight compartment grows worse when the empirical geophysical artist differs from the intuitive geological seer. Each backs his own opinion and if he cannot claim later "We found this field and you were wrong" he would rather have no discovery at all. This is no doubt a relic of the early days of oil prospecting. The geologist was accepted after years of struggle as something more than a charlatan, and transferred the ridicule of "magic" to the geophysicist instead of working and encouraging this bearer of a new set of prospecting tools. He was frightened of having his "nice new rattle" taken away. The geophysicist had, perforce, to justify himself, and developed the gambler's way of applying his new methods—with a pool or nothing, and don't waste time on geological detail. In areas where large structures exist this method is perfectly correct, and it has sufficed to put geophysics on its feet. However, there is no need now to keep up the old jealousies. An exploration department should look for oil by the best possible methods and the geophysicist is established enough in his own right to admit that he provides geological tools without being in any way subservient. The two types of exploration scientist should work together, plan experiments together and write joint reports. Then it will be possible for the man collecting the results to discuss the interpretation (the word used in its proper sense of correlating physical measurements with geological formations) with a knowledge of the relative reliability of the results, and at a time when opportunity is available for removing ambiguities by additional experiments.

There are really two types of problem in looking for oil. Exploration of a completely new area requires a different scientific approach from exploitation of territory in which an oilfield has already been found. In exploring virgin places a great deal of time will be saved if a borehole is started right away rather than waiting for reconnaissance geological or geophysical parties to find a likely oilfield. It is rarely that the borehole located after years of preliminary work finds oil in any case; it might just as well be finding geological information, and geophysical methods are much more powerful when operated from a borehole or an outcrop. The work of the combined geological and geophysical party will be to find geological information. Refraction work should be carried out so that the depths and velocities for all possible layers are found, for until a borehole is drilled it will not be possible to say which strata are likely to be oil-bearing. It may be desirable to make gravity and magnetic surveys to assist in building the geological picture correctly, but in preliminary stages it is not right to use these methods merely because they are cheap and quick. The borehole results may suggest likely oil-bearing horizons, and these may be followed by reflection surveys. If nothing promising is shown by the borehole, enough isolated refraction experiments will have been made to show where the structure has altered, and where a new borehole will be of interest. When a borehole shows a useful horizon, then it should be mapped to give a location on an anticline. The refraction method is very good at extending knowledge rapidly, and in showing when changes occur, and should be used in reconnaissance for these purposes.

As oil is found, old survey results should be re-examined to see to what extent various geophysical and geological indications can show positively where the oil structure is located. It is not a waste of time to do detailed geophysical work over a known oilfield. Admittedly the work could be applied to a new area in search of another field, but for exploiting country where oil is known to exist in a certain form of trap in a specific formation, time will be well spent in working out a good discovery technique. It is possible that geophysical methods are of use only in finding an approximate location, and that the oil has to be pin-pointed by pattern drilling, but it is unlikely that special geophysical methods cannot be devised to cheapen the process. Certainly physical methods of logging boreholes can replace slow coring in the development stage.

American exploration already has the team spirit and geologist and geophysicist, when they are differentiated, understand each other's problems. Both subjects are readily understandable by well-educated members of either profession, and there is little doubt that education will gradually fuse the two subjects for the practical purpose of oil exploration. For the older-established members of exploration departments, working together should show the geophysicist how better to plan his experiments and what improvements in instrumental technique are desirable, and it should show the geologist what geophysics, when flexibly applied, can do in different circumstances. Research must go hand in hand with field problems and should not, as is so often the case, be confined to detailed instrumentation. Plenty of instruments are available now and it is the using of them that needs immediate improvement. In the United States specially equipped parties are used for preliminary survey, but although the gear is important it is really the high quality of geologist and geophysicist that determines successful operations.

There are still many potential oil resources in the world and modern tools should locate these more rapidly than the pioneers who in years gone by have demonstrated what overwhelming and resolute oil-seeking can do. Today we have better instruments and greater knowledge, but the team spirit is split into factional interests of different professions and the responsibility of finding oil is readily cast on to "the other fellow". Pseudo-scientific magic words will never replace energy and purpose.

Petroleum and the Public

The Work of the Petroleum Information Bureau

To make the general public aware of the part played by a particular industry in the economy and life of a country and to make known its activities, difficulties, and achievements is never an easy task. In the case of the petroleum industry it is particularly difficult.

The fact that crude oil has not so far been found in appreciable quantities in the United Kingdom has meant that the petroleum industry as a whole is not a traditional British industry. The pit-head wheel and the slag heap are indigenous to the landscape, the oil derrick and the "Christmas tree" are not. The post-war years have, however, done much to make the petroleum industry a more national affair, for the refineries which have been built in Britain have familiarized the public with the refining aspect of the industry. Tank farms and flare stacks have become accepted landmarks and it can be only a matter of time before the U.K. refining industry is as native as the cotton industry—another "finisher" of imported raw material.

It is obviously desirable that the British public should know as much as possible about an industry on which the nation increasingly depends and in which it has such a large stake. Petroleum's important part in meeting energy demands and the increasing use of petrochemicals in every aspect of life mean that the industry is vital to the nation and that its activities should, therefore, be fully understood. To promote such an understanding is the aim of the work carried out by the Petroleum Information Bureau (PIB) from its offices at 29 New Bond Street, London, W.1.

From the PIB offices goes out a vast quantity of literature, visual aids, and exhibition material, the majority being free of charge. Information is given on any aspect of petroleum, and statistics are compiled on the industry's activities. Material is provided for newspaper publication and lecturers are available to speak in many parts of the U.K. on petroleum matters.

PIB Literature

A comprehensive range of memoranda is published by the Bureau and distributed on request throughout the United Kingdom. During 1954 nearly 100,000 separate pieces of literature were distributed in this way. These memoranda deal in detail with methods of prospecting, drilling, and refining; pipelines, tankers, and inland distribution of finished products, and the main producing areas (with brief notes of their history, the location of each country's oilfields, their most recent production figures, and refining capacity).

Other memoranda are concerned with the world's petroleum reserves, some of the social and economic consequences of oil production in overseas territories, the use of petroleum products in various industries, the production of chemicals from petroleum, the organization of the oil industry, etc.

For those not wishing to go into these matters in such detail there is available an illustrated survey "Notes About Oil" and a simplified "Junior Notes about Oil" for the younger generation. An example of how PIB is constantly striving to widen the scope of its appeal is provided by "The Philatelist's Story of Oil", *i.e.* the story of oil built round a collection of postage stamps depicting overseas oil industry operations. Another example of seeking pastures new is afforded by the recent publication of "The World of Oil", a well-illustrated booklet aimed specifically at "the man in the street". Several thousand copies of this booklet were requested as a result of editorial mention in the Press and it is interesting to note that the largest single body of recipients were members of motor and motor-cycle clubs.

PIB Visual Aids

In addition to literature, use is made by the PIB of many types of visual aids, and the material available includes:—

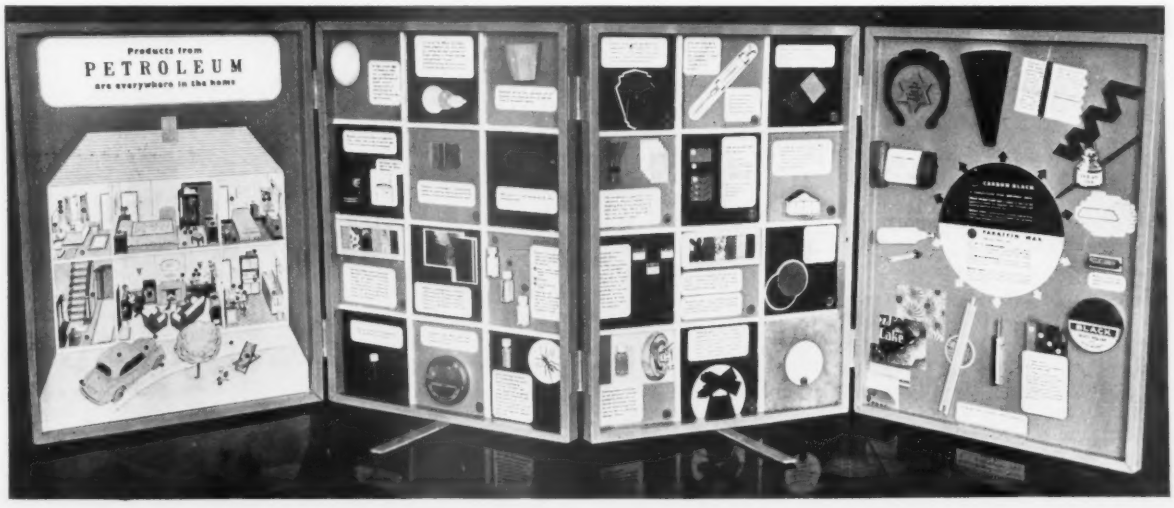
(1) Pictorial wall sheets (giving a brief photographic story of oil, and some of the welfare and educational services provided by the industry in oil-producing areas).

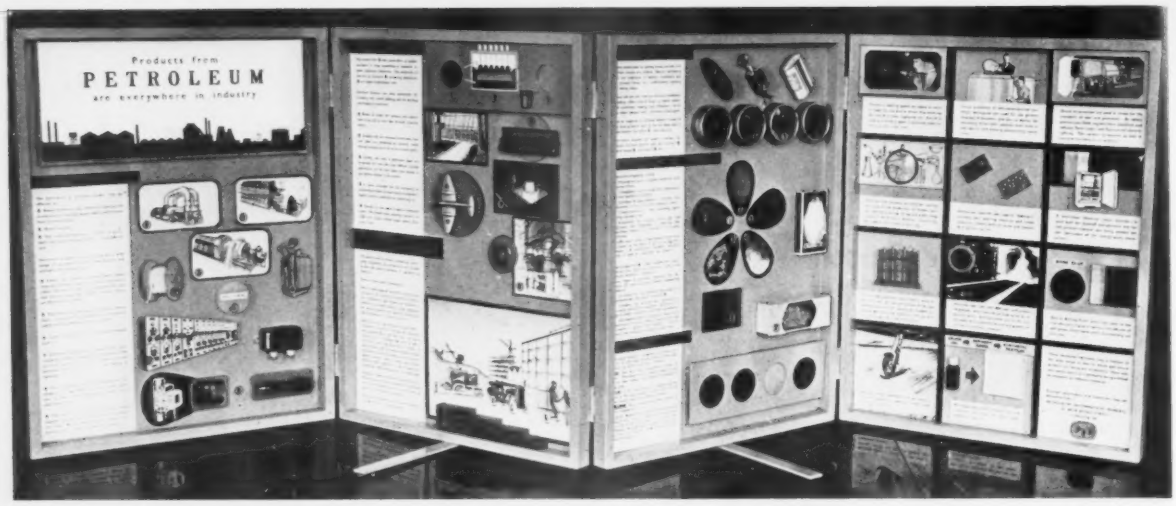
(2) Wall charts, dealing with prospecting, drilling, and refining.

(3) A large map of the world's oil-producing areas.

(4) Filmstrips, including an introductory "ABC of Oil" and four more semi-technical strips dealing with prospecting, drilling, refining, and transport for those who wish to develop the subject more fully. Other film-strips include "Oil—The Pioneers", consisting of contemporary photographs of the struggles of early oil-men, and "The Philatelist's Story of Oil."

(5) Episcope photographs and lantern slides. These, and all filmstrips, are supplied with suitable lecture notes.





(6) Molecular models. Sets of one-inch spheres with wire links for the construction of hydrocarbon molecules.

(7) Mounted photographs, with captions, for wall display.

(8) A picture-set of 15 attractively-coloured panels for wall display describing the origin of oil, exploration, drilling, production, refining, transport, and the various activities of the petroleum industry.

(9) Display cabinets, "Petroleum in the Home" and "Petroleum in Industry", illustrating by means of models and specimens some lesser-known uses of petroleum products.

Distribution

A great deal of this material is, of course, specifically designed for educational purposes and great care is taken to ensure that this technical material is made intelligible to the lay understanding and is also attractive enough to catch and hold attention. Striking examples of this are the display cabinets, ingeniously devised and produced within the PIB office, and designed to direct attention to the many surprising every-day uses of petroleum products.

PIB memoranda are welcomed by a wide variety of organizations, e.g. the Armed Services, schools, industrial organizations and individual firms, free-lance lecturers, public libraries (nearly 200 have complete sets of literature in their reference sections), West-End clubs and hotels, political organizations at headquarters and branch level, youth employment officers, etc. Visual aids too are distributed widely and, apart from individual use, PIB provided, in 1954, material for 40 exhibitions, ranging from an art gallery to a cinema foyer.

PIB Lecture Service

Organizations such as the Rotary Clubs, Round Tables, and women's associations also welcome the Bureau's lecture service whereby skilled and knowledgeable lecturers are supplied to speak on petroleum subjects to organizations throughout the United Kingdom. A large number of lecturers is needed to supply this service and the Bureau is always pleased to hear from retired oil industry personnel who are willing to serve as lecturers. At the present time there is a particular need for lecturers in Lancashire and Yorkshire.

PIB Services to the Press

Press activities are on a substantial scale. They include the periodical issue of statistical material calculated to create understanding of the importance and range of oil industry operations. Additionally, press releases dealing with topical information are prepared from time to time.

Apart from this material, however, PIB issues to some 30 newspapers of the provincial Press each week a motoring column and an industrial news letter, consisting largely of material of a general nature but stressing some fact about oil industry operations; in addition, PIB also supplies to approximately the same number of provincial newspapers two feature articles weekly. These weekly articles usually appear without acknowledgment to PIB, though the national Press is quoting PIB, as the source of news releases, to a progressively increasing extent. In all, there were 1464 reproductions of PIB material in the Press during 1954. Frequently, individual articles are prepared for specialist journals, while PIB news items often find a place in the Home and Overseas Services of the B.B.C. A substantial photographic library is used in connexion with Press and other activities.

Despite this continual flow of work the staff of the Bureau is frequently called upon to verify and explain, before publication, news items received by the Press from other sources, and to help feature writers and authors who are dealing with petroleum topics. Great importance is attached to this aspect of PIB activities since it affords opportunities for correcting many inaccuracies that might otherwise find their way into print. It is a pleasing indication of the prestige attained by PIB in press circles that many organs of the national Press are constantly consulting the Bureau.

PIB Enquiry Service

The Bureau is regarded as a ready source of information on petroleum matters not only for the Press and writers in general but also for a wide range of enquirers, *e.g.* banks, stockbrokers, insurance companies, political organizations, learned and industrial organizations, foreign embassies, etc. Exhaustive indexing of facts about the industry has provided the Bureau with an unparalleled store of factual and non-technical information which is being increasingly utilized.

At a time when it is increasingly difficult for the average person to keep abreast of scientific and industrial developments, PIB is providing an invaluable and expanding information and educational service. The interests of the petroleum industry require that its activities should be fully publicized to avoid misunderstanding of its position in the British economy; it is equally advisable that the public at large should take an intelligent interest in the activities of such an essential industry. The staff of the PIB is carrying out the task of interpretation and presentation with a purposefulness which combines both care and imagination and is making a large number of friends for the industry in the process.

Around the Branches

BAHRAIN, FAWLEY, KUWAIT, LONDON, NORTHERN, SCOTTISH, SOUTH-EASTERN, SOUTH WALES, STANLOW, TRINIDAD

Fawley Branch

Visit to the *Winchester Castle*

On the morning of 3 September 1955, a party from the Branch visited the m.v. *Winchester Castle* in Southampton Docks. This vessel is one of the comparatively older vessels of the Union Castle Line, of some 20,000 tons, twin-screw, and built in 1930 by Harland and Wolff for the South African mail run. Its inward cargo consists mainly of fruit, wool, and skins, and its outward cargo is general. As members of the Branch had expressed a wish to see the engine room units, most of the time was spent there, but a brief glimpse of the promenade public room was obtained at the end of the tour.

The party was conducted through the engine room where the main propulsion units were in process of a partial overhaul and inspection. Two banks of ten cylinders to each bank, and two cycle double-acting diesel engines constituted the main units. The power developed was approximately 25,000 h.p., and at 106 rev/min the vessel's speed was 20 knots. Originally the horsepower was 14,000 with DA.4 stroke engines, but the vessel was re-engined in 1936 to give the increased power of 25,000 h.p. With the partial overhaul and inspection under way, the party was able to observe the design construction of the units and to follow the guide's explanation of problems encountered and changes made.

Leaving the main engine room, the tour concluded with a visit to adjoining rooms, where the usual ancillary equipment such as pumps, compressors, electrical generators, etc., was seen.

H. G. Garvie expressed the appreciation and thanks of the party to Mr Chadwick of the Union Castle Line for the time he had given and for making the visit most enjoyable and interesting.

South Western Tar Distilleries

On 17 September, a small party from the Fawley Branch made a visit to the Totton Works of South Western Tar Distilleries. The party was conducted around the works by S. C. Clarke, the works manager.

Totton Tar Distillery is situated on the north-west tip of Southampton Water and alongside the Totton by-pass on the Southampton–Bournemouth road, and is thus well placed to receive its raw materials from gas works in the South of England, Channel Islands, and the Isle of Wight. Shipment is also made via Southampton Water of pitch creosote and road tar both for home and overseas buyers. The road fleet consists of some thirty vehicles which are used for collecting the raw materials and distributing the products.

The crude tar when received is stored in tanks having capacities ranging from 2000 to 5000 tons and a further tank is nearing completion which will hold 7500 tons and where some of the entrained ammoniacal liquor will be settled out.

The crude tar is distilled in a pipe still of Wilton design which has superseded the continuous battery of pot stills which is, however, maintained in reserve in case of need. The Wilton continuous unit has a daily capacity of 250 tons, and separates the tar into seven well-defined oil fractions, namely crude benzole, heavy naphtha, carbolic oil, naphthalene oil, creosote, anthracene oil and a heavy residual oil. These products are measured by means of magnetic rotameters and the plant is fully instrumented. The plant uses its own end-product as fuel for the burners.

The crude benzole is distilled on the works, about 300,000 gallons per annum being obtained from the tar distillation and a further 1,700,000 gallons from Southern Gas Board undertaking. This rectification produces motor benzole, crude toluol, and solvent naphtha. The crude toluol is further refined to produce toluene. The plant produces over one million gallons of motor benzole per annum.

The three fractions after the crude benzole contain phenols, and these are extracted with caustic soda, between 500,000 and 600,000 gallons being produced annually. The limekiln, burning limestone, produces CO_2 and lime. The CO_2 is used to liberate the crude phenols from the sodium phenolate, and the lime to recausticize the resultant carbonate liquor.

The crude sodium phenolate is distilled under vacuum before carbonating, and the recausticized soda solution is freed from waste calcium carbonate on a rotary filter. The naphthalene oil fraction, after extraction of phenols, is cooled to deposit the naphthalene, and this is recrystallized to give good quality naphthalene. The creosotes remaining after treatment are blended to a number of specifications, and despatched to both home and export markets by road, rail, and sea.

London Branch

The 1955-6 session opened on 22 September with a talk by J. W. Eyre on the "History and Development of the Petroleum Industry in the United Kingdom".

After describing the rapid increase in demand for petroleum products both for lighting and lubrication which followed the Industrial Revolution, Mr Eyre went on to describe the methods used in importing oil from the United States. In the 1860's both kerosine and lubricants were imported in wooden barrels with considerable leakage and it was not until the latter part of the century that ocean-going tankers were used. In the 1890's electricity and gas were reducing the demand for kerosine but about this time the advent of the motor car, followed by the removal of the Highway Act in 1896, caused a demand for benzine, later known as petrol. In 1912 the British Admiralty decided to convert the ships of the Royal Navy to burn fuel instead of coal, a policy which gave a tremendous impetus to the industry.

Mr Eyre then reviewed the government control of petroleum products during the first world war, the effect of the railway strike of 1919 in encouraging road transport, and the introduction of road diesels in 1928 for commercial vehicles and later for public transport. On the outbreak of the second world war the Petroleum Board and Lubricating Oil Pool began to operate. There were difficult problems involved in diverting imports to West Coast ports and it was during 1943 that the small but important contribution of petroleum from indigenous sources reached its peak of 600 tons per month.

Following the war, the national companies had to take stock of the situation and decided on a fresh programme of expansion by embarking on new refinery construction for home refining of crude oil. This had the advantages of using indigenous labour, saving dollars, and assisting the petroleum chemicals industry. Mr Eyre concluded his paper with a review of the results of post-war research resulting in new fuels for jet aircraft, manufacture of town gas from fuel oil, and the use of by-products for the manufacture of synthetic detergents, aids to agriculture, insecticides, and many other materials.

A vote of thanks was proposed by George Sell and was heartily endorsed by all present.

Scenes at the South Eastern Branch Dance

Scottish Branch

The first meeting of the 1955-6 session was held in the North British Hotel, Edinburgh, on Thursday, 20 October when Mrs M. Ritchie of the Industrial Relations Department, Personnel Management Advisory Service, Ministry of Labour and National Service, spoke on the subject of "Some Human Problems of Industrial Change".

Mrs Ritchie referred to the changes which have taken place within the last 20 years in industry and in the attitudes of people, and referred to some of the reasons which had led to this change. Whilst prominence had been given to technical development, said Mrs Ritchie, we had sometimes forgotten the difficulty which this development causes in the hearts and minds of men and women. Today there were often barriers which might hold back effort, and the problem of management was to harness the desire to work, in the interests of productivity, and in the interest of all who work in a firm. Some of the human problems which existed in industry today concerned the necessity for a high standard of management at all levels, discipline, the attitude to production, opposition to change, and fear and apathy. It was frequently proved that the man who did the best job was not necessarily the one who was highly paid, or who had the best tools, but the one who found interest and satisfaction in his particular job.

The solution to these problems lay primarily in good management and many firms had been seriously concerned, and had considered how the right industrial atmosphere might be obtained. Contrary to the belief of many, financial rewards were not the only incentives. When the wages structure was sound other aspects had an effect on the effort and interest which people put into work, such as working conditions, standard of management, particularly that of the worker's immediate chief, steady employment, and the possibility of promotion. Where there was considerable resistance to change, this was frequently due to the fear of how this change was going to affect the individual or a department, and was sometimes entirely due to the lack of clear explanations. The difficulty found in conveying the right information and the difficulty of consultation were fundamental problems which had not yet been entirely solved in British industries. Although one frequently heard criticism of the uninterestedness of young employees, perhaps industry sometimes failed to create and maintain that interest, and failed to give them a feeling of achievement and pride in the job they were doing. These human problems were a challenge to all in industry if we were to create the spirit of co-operation which can accomplish so much. If we failed to meet this challenge then we would be seriously handicapped in the efforts to improve productivity.

J. M. Caldwell, chairman of the Branch, who presided at the meeting, proposed a vote of thanks to the speaker.

South-Eastern Branch

As a departure from usual practice an experimental meeting was held at Grain on 20 September, taking the form of a film show. The holding of this meeting at Grain was an outcome of the Committee's suggestion that the Branch's activities should not be confined to Rochester. The meeting was well-attended and the interest shown was encouraging.

On 4 October, a meeting was held at the "King's Head" in Rochester, at which G. F. J. Murray of the British Petroleum Company Ltd gave a paper entitled "Industrial Oil Burners, their Application and Some Recent Related Developments". The paper was well illustrated with slides and contained a great deal of interesting information concerning the types of burners normally used in industry, and also some of the interesting developments in the use of oil fuel in the steel and cement industries in particular. The discussion which followed continued during the interval for coffee and reflected the interest which Mr Murray's informative paper had aroused. The meeting closed with a film "The Good Old Days".

South-Eastern Branch Dance

On 6 October members and friends of the South-Eastern Branch gathered at the Central Hotel, Gillingham, for the Annual Dance. Total attendance was well over 100 and visitors included the Institute's General Secretary, D. A. Hough, and Mrs Hough, and George Sell, the Editor, and Mrs Sell. During the evening, entertainment in the form of a floor show provided by local talent was much enjoyed. Dancing continued until 1 a.m. and everybody agreed that the Committee of the Branch were to be congratulated on having arranged a very happy function.

Chairman, a Committee Member, and the Hon. Secretary, all pleased with the S.E. Branch Dance.

Trinidad Branch

The Trinidad Branch held its monthly meeting on 27 May in the Reading Room of the Pointe-a-Pierre Club. The late Dr Gustav Egloff, one of the world's leading authorities on the science of oil processing, had intended to visit Trinidad and was to have presented a paper before the Branch. The Chairman of the Branch, J. A. Hulme, commented on the great loss that Dr Egloff's death meant to the oil industry.

In place of this talk, Dr Newton of Trinidad Leaseholds Ltd read a paper which he was later to present at the 4th World Petroleum Congress in Rome. Dr Newton's paper concerned the relative effect of deactivating agents on silica-alumina catalyst employed in catalytic cracking. In view of the high cost of catalyst, research into the problem of lengthening the life of this catalyst was of vital economic importance, said Dr Newton. Research had shown that the presence of steam, high temperature, metallic contamination,

and high carbon content were the main factors reducing the effectiveness of the catalyst.

Following an interesting discussion, Dr A. L. Down proposed a vote of thanks to the speaker and wished him every success in his trip to Rome.

Papers on Drilling Operations

The 147th General Meeting of the Branch was held at the Clifton Hill Club on 24 June.

G. P. Laird and A. D. G. Arch of Trinidad Leaseholds Ltd read the first paper of the evening on "Drill Stem Testing Technique for Deep Herrera Sands".

The paper described an open-hole drill stem testing technique which is currently used to evaluate formation fluids content of sandstones encountered at depths of the order of 10,000 feet. The tests are conducted in a medium of an oil-base drilling fluid having a density of 115lb per cubic foot. Fundamentally, the technique is strictly conventional and has been developed using standard equipment, some of which is now obsolescent. Development has been directed towards guaranteed test success and economic minimization of the hazards involved.

A unique feature of the test assembly is the use of a drillable anchor (or tailpipe) in lieu of an orthodox perforated steel anchor. The open-hole packer is integrated with the drillable anchor and the combination nullifies the hazard of sticking the packer and/or anchor during testing.

The second paper, "An Analysis of the Causes of Loss of Circulation in U.B.O.T. Drilling Operations" was given by A. L. Crockford, exploitation engineer, of the United British Oilfields of Trinidad. Mr Crockford said that the purpose of the investigation was to analyse the causes of fluid loss in the U.B.O.T. Point Fortin West Field; nevertheless, the conclusions in general applied to drilling operations in many areas throughout Trinidad.

He explained that the exploitation of the Point Fortin Area had fallen into three distinct phases. During the initial development of shallow horizons no specific drilling problems were encountered but later, when penetrating deeper horizons, gassy flow-line returns were often observed. Loss of circulation commenced with the third and present phase of the operations and constituted a potential hazard in all wells drilled adjacent to, and to the north of, the major Los Bajos fault, in the proximity of which there was an extensive region of minor faulting and general disturbances. High formation pressures prevailing above the fault necessitated the use of high density drilling fluids of between 105 and 125lb per cubic foot and due to the extensive fluid offtake from some sands during earlier exploitation and the disturbed nature of the formation, fluctuations in down-the-hole pressures caused by pipe movement resulted in the rapid development of fluid losses.

Mr Crockford then pointed out that the association between past and present difficulties could be explained by the magnitude of the pressure surges resulting from the movement of the drilling assembly within the hole at normal velocities, since there was both an increase in mud density due to a more comprehensive understanding of formation characteristics and a reduction in initial reservoir pressure.

A review of the drilling data compiled during the current exploitation programme revealed that loss of circulation occurred in 13 out of 27 wells between the depths of 300 and 1700 feet. Mr Crockford then presented his analysis of the effect on bottom-hole pressure surges of variations in drilling assemblies, hole diameters, pipe tripping speeds, and mud properties, which had led to the following general recommendations for reducing the incidence of loss of circulation.

(1) The maintenance of maximum diametral clearances.
(2) The restriction of pipe moving velocities during round trips, particularly when operating in the shallow section of the hole with jet type bits.
(3) The careful control of the density of the barytes-laden mud, maintaining the minimum value in accordance with safe drilling practice. To avoid gas contamination following a reduction in mud weight, extreme caution should be exercised when pulling pipe.
(4) The elimination of the tendency of "balling-up" when tripping, by circulating intermittently, and when drilling, by maintaining adequate circulation rates for cuttings removal.
(5) Avoiding the reaming of drilled hole while maintaining full circulation, especially with jet type bits.
(6) When establishing circulation, pumps should be opened up very slowly, particularly during and after tripping and when making drill connexions.
(7) The reduction of the value of critical mud properties, such as yield strength and plastic viscosity, for a given fluid density, should be attempted.

A lively discussion followed, after which the Chairman thanked the authors for a most interesting evening.

Paper on Gas Turbines

Jet engines and turbo-prop engines had been very much in the public eye, with the visit to Trinidad of the Canberra jet bombers and the recent arrival of the first Viking turbo propeller airliner for B.W.I.A., when on 26 August the Branch discussed the development of the gas turbine, or jet engine as it is popularly called, for stationary and marine uses. J. W. Hardy, chief engineer of Trinidad Leaseholds Ltd, and J. S. Cox, Forest Reserve power station superintendent, delivered a paper on gas turbines to a gathering of oilmen at the Apex Club House with Dr A. L. Down in the chair, and supplemented their talk by a film on the subject prepared and loaned by the Shell Oil Company.

After discussing the fundamental considerations of the gas engine, steam turbine, and gas turbine, the authors described the development in the post-war years of the stationary gas turbine, with particular reference to electric power generation. The relative merits of the reciprocating gas engine, the gas turbine, and the steam turbine were dealt with in some considerable detail and it was gathered that, particularly for peak load electric power generation, the gas-turbine-driven alternator had a number of advantages over its steam-driven counterpart, particularly if natural gas was available. One big advantage of the gas turbine, particularly the simple cycle or non-regenerative type, was its low water consumption—the obtaining of a large supply of good quality water necessary for the continuous operation of steam turbine condensers had always been a problem in Trinidad. Other advantages were the ability of the gas turbine to take full load quickly, low first cost, simple control, and high power to weight ratio.

The main disadvantage of the simple cycle turbine was its relatively low efficiency and the authors concluded by showing a number of methods by which efficiency could be improved and the gas turbine made more attractive to countries where fuel costs were higher.

E. G. Marsden, who had recently visited the Oklahoma Gas and Electric Company's power station at Belle Isle and seen two gas-turbine-driven alternators in operation, opened the discussion and commented favourably on the low maintenance and running costs that had been experienced by this and other American users. Mr Cox outlined the development of gas turbines in European countries, particularly the U.K., dealing specifically with the use of gas turbines in warships and drawing attention to the recent trials of H.M.S. *Grey Goose*, the first British warship to be driven solely by gas turbines.

Personal Notes

Lt.-Col. S. J. M. Auld, O.B.E., M.C., D.Sc., president of the Institute of Petroleum, has recently been elected to the Executive Committee of the British Standards Institution.

J. W. S. Straughan has been appointed Chief Engineer Superintendent of The British Petroleum Company's British Tanker Company in succession to the late A. Aitken.

Mr. Straughan was apprenticed with Smith's Dock Co Ltd at South Shields and after service at sea as a junior engineer he joined the British Tanker Company as 3rd Engineer in 1917. He was appointed Chief Engineer in 1919 and Superintendent Engineer in 1937.

Sir Bernard Keen, D.Sc., F.Inst.P., F.R.S., has been appointed scientific adviser to Baird and Tatlock (London) Ltd. Until recently he was Director of the East African Agriculture and Forestry Research Organization.

C. S. Parkin has been appointed divisional manager of Vacuum Oil Company's industrial division in South Wales, the headquarters of which are at Cardiff.

H. E. Snow, C.B.E., has been reappointed to the Board of The British Petroleum Co Ltd as a managing director, on relinquishing his appointment as general manager of Iranian Oil Participants Ltd on 31 October 1955.

A. Hofland, O.B.E., has been appointed a director of The Shell Petroleum Company Ltd and The Anglo-Saxon Petroleum Company Ltd.

E. E. de Bruijn, co-ordinator, Exploration and Production Group, and **J. L. van Krimpen,** co-ordinator, Manufacturing Group, have been appointed deputy directors of N. V. de Bataafsche Petroleum Maatschappij.

J. K. Morrison, divisional office manager of Vacuum Oil Company's Scottish Division, has served for 45 years with the Company. His career began when he joined the Company as an office boy in Glasgow and his progress to his present position was unbroken save for his war service with the King's Own Scottish Borderers from 1914 to 1919.

T. F. Doyle has accepted a seat on the Board of Irish Shell Ltd, distributors in Ireland for the Shell Petroleum Co Ltd, The British Petroleum Co Ltd, and the Eagle Oil and Shipping Co Ltd. Irish Shell is one of the principals concerned in the refinery development at Whitegate.

Mr Doyle is Vice-Chairman of the Cork Harbour Board and has many business interests in Cork.

W. C. Ikeson, M.B.E., A.M.I.Mech.E., M.I.Loco.E., M.Inst.Pet., has been awarded the 1955 Howard Prize of £50 by the Royal Society of Arts for a treatise on mechanical motive power. His essay was entitled "A new conception of the oil-fired steam locomotive".

Fifty Years with Vacuum

In September this year **W. E. Archer,** a tank dipper at the Wandsworth Works, completed half a century of service with the Vacuum Oil Company. Mr Archer first joined the Company as a messenger boy in 1905 when its activities were limited to the manufacture and marketing of lubricants and allied products. The fifty years of Mr Archer's service have seen the expansion of the Company to its present position as a producer of a full range of petroleum products.

Mr Archer was presented with a television set from the directors as a tribute to his devoted service and was guest of honour at a luncheon given by members of the Board to celebrate the occasion.

D. Drummond

D. Drummond has recently been appointed to the Public Relations Department of Esso Petroleum Company Ltd in an editorial capacity. Mr Drummond will collaborate with Keith Thomson, who is responsible for the Company's Public Relations publications, in the production of *Esso Magazine*.

After his war service, Mr Drummond became general editor of the publications of the John Lewis Partnership and later joined the Ford Motor Company Ltd as editor of *Ford Family*.

S. C. Stewart has been appointed general manager of the Industrial Alcohol Division of The Distillers Company Ltd.

Mr Stewart, who has been a director of the Division since its formation, is also a Division Director of British Industrial Solvents and of The Carbon Dioxide Company.

Dr J. T. McCombie, B.Sc., A.R.I.C., A.R.C.S., has been appointed general sales manager of the British Industrial Solvents Division of The Distillers Company Limited.

NEW REGENT APPOINTMENTS

Reorganization of the General Sales Division of the Regent Oil Co Ltd has recently taken place and **O. H. Fish,** former dealer sales manager of the Company, has been appointed general sales manager. Mr Fish, who joined Regent in 1954 after service with the California Texas Oil Company, New York, has had wide marketing experience in the petroleum industry both in the U.S.A. and other parts of the world.

R. A. Munro has been appointed assistant sales manager and will be responsible for dealer sales development. Mr Munro was also employed by the California Texas Oil Company before joining Regent in 1953. He was formerly manager of Regent's Sales Promotion Department and has been succeeded in that position by G. L. Macnaghten.

OBITUARIES

The death occurred on 26 September of E. E. Fidler, communications manager of Shell-Mex and BP Ltd until his retirement in July 1954. When Mr Fidler retired he had served the Company for 38 years and he later continued to advise the Company as part of the private consultant practice in communications which he established.

Mr Fidler first joined the British Petroleum Company in 1916 and on the merger of Shell-Mex and British Petroleum Ltd in 1932 he took charge of the mailing room at the head office of the joint company. From that date he built up a reputation as an authority on telecommunications and office mechanization and so unique was his work for the Company and for the Petroleum Board, which he served during the war years, that it had widespread effects on government organizations and on private industry throughout the world.

It is with regret that we record the death of Herbert Lewis Hawkes, an associate member of the Institute and technical representative of the Manchester Oil Refinery Group of Companies. He had been associated with this Group since 1939 and was well known in Heaton Mersey and Stockport.

Investment in the Oil Industry

A report of discussion following a paper delivered by F. C. Waddams to the IP Economics and Operations Group on 4 October 1955 and printed on pages 281-4 of the November IP Review

P. M. de Veulle: This is probably the first time that this important subject has ever been discussed at a meeting of the Institute. We are fortunate that in introducing this subject to the Institute, we have had a speaker who has been clear and precise and who has not intimidated us by his millions, nor by the jargon which is usually associated with this subject.

I was not too clear at one time whether he was speaking essentially of the sterling oil companies, or whether he was speaking of the oil companies as a whole, that is, including the American and other companies. Because we must clearly distinguish; I think it is true to say that American companies appear to distribute more to their shareholders than the sterling companies who, it would seem, need to retain much more for re-investment than the large American companies. I imagine that, to some extent, this is a reflection of the distribution of their trade and of the capital markets in the U.S.A. and the U.K. It was surprising that a short while ago a Canadian pipeline company was able to borrow money in the U.S.A. cheaper than an ordinary public utility. There has been a great change in the sources of new funds, and I believe it is a fact that many pension funds and—until the present credit "squeeze"—insurance companies had difficulty in finding suitable investments.

In the old days oil was regarded as a tremendous risk. Today, however, the yield on a leading oil company's shares, at current market price—which is a reflection of what the investor asks—is below that on gilt-edged securities. The past few years have seen a great change in the attitude towards oil investment.

Would Mr Waddams say more about the somewhat novel theme of defensive investment—that you have to invest money merely to stay in the business. Perhaps we must revise our terminology. It may be that that kind of investment is not true investment at all, but should be regarded as current expenditure.

J. Clarke: It seems to me that the oil industry is moving somewhat out of line with other industries. One does not hear other industries talking about defensive investment. It may be that my reading has been rather limited or that it has not been brought to my notice, but it seems to be a characteristic at the moment of the oil industry to regard its position as requiring so-called investment of that nature. Perhaps the speaker could enlighten us.

Another point, too, is that the oil industry seems to be more severely afflicted with capital requirements than others, which again seems to put it somewhat out of line with the general run of other industrial concerns. There is a general necessity for capital, which is much voiced, but not with the same emphasis that one seems to hear in the oil industry.

Another point is that the industry seems to move in waves. For instance, there was the tremendous work of refinery construction. That, of course, was partly dictated by delayed action, if there had not been a war it would have happened gradually, but in fact it came in one very substantial wave. One sees the same trend in the ocean tanker market. It is not one company which produces a programme, it is virtually all the companies together, and consequently we seem to go from a period of boom, in terms of profit, to a period of depression. I think it is true to say that we have been going through a period of relative depression, and the figures quoted seem rather to substantiate that. Profits have been at a relatively low level within the industry and presumably they are now working up to a better prospect, which is inviting additional investment.

A. Grimshaw: If I may refer to the question of the ratio of net profits to capital investment by British companies and American companies, I look at that, possibly, in a slightly different way from your first questioner. It is true that the proportion is lower on this side, but I think that it will be found that the ratio of capital investment to profits before tax is very similar. One understands why it is similar because we each try to keep our competitive position in the industry. The reason why net profit is a much smaller proportion in the U.K. compared with the U.S. is because the tax man takes so much more in the U.K., and so the shareholder is left with very much less. That is the way to look at it—the ratio of capital investment to profit before tax is consistent, as you would expect; but the tax man here gets more than his share, and that is why the American companies are so very much better off in that respect. As Mr Waddams has pointed out, percentage depletion is the main single feature. The Americans have three very lucrative advantages over us; one is the percentage depletion allowance, which has been very profitable for them; the second is their ability to expense their exploration "intangible" costs, instead of having to capitalize them as we have to do; and the third is, of course, the privilege of being able to set up a "Western Hemisphere Trade Corporation" for operations outside the United States, in the Western Hemisphere, and get a 14-point reduction in their tax bill. The result of all these allowances, of course, is that the U.S. companies pay about 30 per cent, on the average, in tax, although their regular rate is 52, and our rate, as you know, is in excess of 50, if all the taxes are taken into account. So it is those allowances, primarily, that allow them to generate these very large sums, and keep ahead of us in the race, so that our shareholders have to be content with a lower return.

J. Clarke: Mr Waddams referred to the return on investment being in the region of 12 per cent. Could he confirm whether that is after tax, which I imagine it is, or before tax?

F. C. Waddams: The figures of the return on investment are after deduction of tax.

The first point has been dealt with by Mr Grimshaw, and there is little more for me to say on that subject. The American companies, in fact, pay out as dividends considerably less than 50 per cent of their net earnings on average.

The question whether there are not adequate external sources of funds for investment I tried to deal with when I said that people are prepared to invest in a going concern, and that any given sum of money would be forthcoming at a price. The price conditions—to use economic jargon—can be depicted on a graph which measures on the horizontal axis the degree of risk from zero to infinity, and on the vertical axis return on investment from zero to infinity; then for any given sum of money to be forthcoming for investment there will be a separate curve which is asymptotic to both axes. The money will not be forthcoming for a nil return, nor for an infinitely great risk, so that the curve will start on the vertical axis at higher than zero return measured on that axis, and will never reach the point on the horizontal axis which measures an infinitely great risk.

If money is raised from outside sources, it is normally raised either as equity capital or as borrowings. So far as

equity capital is concerned, I mentioned that to do this to any great extent would cause a danger of over-capitalization in lean times, particularly since the return on investment has recently been falling, and the return on new investment has been, in the last year or two, low. In my view it is doubtful whether the oil companies could satisfy investors' requirements to raise even a fair proportion of the money involved.

So far as long-term borrowing is concerned, it has been found in practice that there is a certain percentage of total investment above which it is undesirable to take borrowing, in the interests of one's general financial soundness and credit.

There are other factors which make it difficult to raise more than a proportion of the sums needed. For instance, refineries are required in far-away areas of consumption, where exchange and other controls have an uncertain effect, and where the operation is not always economic, because pressure may be brought to establish refineries in areas of consumption which cannot provide an adequate market for the refinery products under normal conditions. Thus it is difficult to imagine that money could be raised for many such purposes as separate self-supporting ventures even in New York, the Mecca of money raising in the world today.

So for these and other reasons the present methods of combining internal and external finance have been found the most practical. They can be varied within certain limits, but not fundamentally. Outside finance is more suited to some operations—such as pipelines or tankers, where the assets involved may be easily recognized and segregated—than to others.

I agree there is some logic in the point that if investment is defensive it is not investment. It may in fact be considered as a cost of the business—of staying in business successfully. Nevertheless, the funds so used are devoted to the purchase of property, plant, and equipment, and in this sense are investments.

On Mr Clarke's question—is this defensive investment peculiar to the oil industry or does it occur elsewhere—there are undoubtedly signs of similar trends in other industries, and indeed this feature has been defined as a certain stage in the development of the trade cycle, which we hope has gone for ever in its severe manifestations. Many industrial companies' published accounts show similar tendencies, and I think they are fairly widespread; in the oil industry the tendency has been largely the result of intensifying competition with adequate supplies of the raw material available.

The second point was whether there was really a necessity for all this capital expenditure. There are, it is true, times when a lot of different people acting independently come to a similar sort of conclusion at the same time—that heavy investments must be made in new assets. There was, for instance, a wave of refinery building in Europe after the war, and a wave of tanker ordering in 1951-2, which might give the impression of excessive investment, but I do not think that because it comes in lumps the investment is any the less necessary. The capital assets of the oil industry are not excessive in relation to the volume of products which must be supplied to the markets, nor is investment at present excessive in relation to the anticipated increase in demand over the next few years.

O. F. Thompson: I would be inclined to say that these waves were more apparent than real, and that if you look at the capital expenditures of the major companies they have, after all, been fairly consistent, and have been increasing during the last four or five years at a fairly consistent pace.

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LABOUR STATISTICS FOR THE U.K. PETROLEUM REFINING INDUSTRY

The following figures are taken from the September 1955 issue of the *Ministry of Labour Gazette* (cf. previous figures given in the *I.P. Review* (1955, **9**, 116)).

Figures in bold type are the averages for all the industries covered by the tables.

	Men (21 *and over*)	*Youths and Boys*	*Women* (18 *and over*)	*Girls*	*All Workers*
No. of wage-earners covered by remuneration statistics	16,820	644	796	15	18,275
Average earnings in last pay-week in April, 1955 (shillings)	227·4 **217·5**	95·3 **90·11**	117·2 **112·5**	— **71·6**	217·9 **182·3**
Average number of hours worked in this pay-week	49·6 **48·9**	46·6 **45·0**	44·6 **41·9**	— **42·7**	49·3 **46·9**
Average hourly earnings in this pay-week (pence)	55·0 **53·4**	24·5 **24·2**	31·5 **32·2**	— **20·1**	53·0 **46·6**
			Males	*Females*	
Numbers employed (July 1955)			32,500	6,900	39,400
Numbers unemployed (at 15 Aug. 1955)			138	26	164
Labour turnover rate (4 weeks ended 25 June 1955)					
No. of engagements per 100 employed			1·5 **2·1**	1·8 **3·1**	1·5 **2·4**
No. of discharges and other loss per 100 employed			1·0 **2·2**	1·7 **3·3**	1·0 **2·5**

The Gas Council's Annual Report

Progress in Gasification of Oil and in the Search for Natural Gas

In its 6th Annual Report, which covers the year ended 31 March 1955, The Gas Council states that its research and development work continues on the lines indicated in the previous Report. Included in the work are investigations into the production of gas from sources other than coal and a search for natural gas.

Gasification of Oil

Particular attention has been paid to gasification of heavy oil which has been carried out on a commercial scale at Sydenham by the Segas process since February 1953, and at Stafford by the Onia-Gegi process since May 1954. Both plants have a capacity of one million cubic feet of gas a day. At York, a Segas plant of 0·9 million cubic feet capacity has been in use since July 1954. Two plants operating a third process are in operation at Gloucester and Cheltenham, and one using an American process is on order.

In order to gain extensive experience of the Segas and Onia-Gegi processes, other plants are to be erected. At the end of March the five plants at work and the sixteen on order represented a total daily capacity of 31 million cubic feet and a saving of 364,000 tons of coal a year. A further nine plants with a total daily capacity of 16 million cubic feet were then under consideration and experiments were proceeding with the production of gas from fractions other than heavy oil.

In 1954-5 the quantity of gas produced by the gasification of oil was 3,920,300 therms (1,924,500 in 1953-4), for which 716,800 gallons (329,200) of gas oil and 3,591,600 gallons (1,932,500) of heavy oil were used, a total of 4,308,400 gallons (2,261,700).

Detailed discussions were also in progress with the oil companies for the supply of refinery "tail" gases and the questions of quantity and continuity of supply were receiving consideration as well as the technical aspects. In 1954-5 the North Western Board purchased 5·9 million therms of "tail" gases, compared with 4·7 million therms in 1953-4.

Search for Natural Gas

The Council plans to spend £1 million on a programme of exploration for natural gas in the U.K., the search being conducted by the D'Arcy Exploration Company Ltd. Total expenditure for the year under review was £188,318, the full expenditure on the work to the end of March 1955 being £406,920.

Extensive areas in Lincolnshire and in the North and East Ridings of Yorkshire have been surveyed and at the time the Report was prepared the results were being examined with a view to test wells being drilled. At a Press Conference when the Report was issued on 18 October, Henry F. H. Jones, M.B.E., M.A., deputy-chairman of the Council, said that a site for a well had been located at Hunmanby, near Filey.

After reviewing earlier geological surveys, sites were chosen at Crowborough Warren and one well was drilled to a depth of 4583 feet. Since the end of the year under discussion a second well had been drilled, said Mr Jones, near Crowborough Golf Course. Although gas-bearing strata had been found as anticipated, it was unfortunate that the shows of gas encountered were not sufficiently encouraging to justify further work in the area.

Should natural gas be found in commercial quantity in the U.K. a number of technical questions will arise in relation to its production and utilization. Studies of the practices in the U.S.A. and in Italy have been made and the Council believes it has available all the information necessary for the speedy and economic use of any natural gas found.

Liquefied Petroleum Gases

There are four plants operating to produce gas by the mixture of air with butane and propane. They are at Whitland, Carmarthenshire; Bungay and Framlingham, East Anglia; and St. Just, Cornwall.

Liquefied Gas Imports

If natural gas is liquefied by reduction of temperature, its volume is reduced to 1/600th of its normal volume and it remains in that state at atmospheric pressure if the temperature is kept low enough. The technical problems of transporting liquefied gas to the U.K. from overseas oilfields are under investigation.

Research

Among the work undertaken at the Midlands Research Station, a pilot plant study of the hydrogenation of fluidized coal has been followed by preliminary work on the gasification of heavy oil and crude oil in hydrogen under pressure. The oils seem suitable for efficient conversion to gas with a substantial yield of benzol. The pilot plant has been enlarged.

A pilot plant has been installed to develop a non-catalytic process for the production of gas by the interaction of petroleum with highly saturated steam. It should be capable of operation in large units.

For stand-by gas-making plant, an oil-gas process has been developed in which the heat required is provided by partial combustion of the oil. Units of 1½ million cubic feet a day have been successfully worked and units of double that size are being designed.

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AWARDS FOR CORROSION ESSAYS

The Corrosion Group of the Society of Chemical Industry has established a competition to encourage those who are in the early stages of their career to take an interest in corrosion science.

A prize of the value of 25 guineas is to be awarded annually for an essay or paper on any aspect of corrosion of metals. Essays are invited from persons under 27 years of age on the closing date, which is 31 March, 1956, and a length of about 3000 words for the essay is suggested, although reasonable latitude may be exercised. It is not necessary that entries should include the results of original research, and they may, for example, cover surveys of knowledge in a particular field, discussion of practical problems, suggestions for developments in research, in application of knowledge, or in organization of preventive measures.

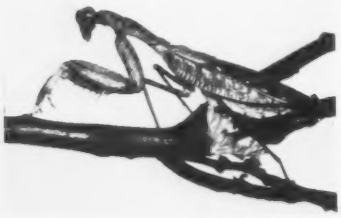
Entries should be typed, double-spaced, and must bear a pen name. A sealed envelope also bearing the pen name and enclosing the writer's full name, address, and date of birth must accompany the entry. Diagrams and photographs must not provide means of identifying the author.

Essays should be sent to: Corrosion Group Essay Competition, c/o Society of Chemical Industry, 56 Victoria Street, London, S.W.1.

Books and Films

Our Insect Rivals

The human population of the earth is about two thousand million; the insect population is about the same number to every square mile. Many insects are the enemies of man—they eat or destroy one-third of the food he grows, they destroy his property, and bring death and disease. To focus attention on this subject the Shell Film Unit has produced *The Rival World*, a 25-minute Eastmancolour film in which the operations of the hostile insects are shown and some means of combating the threat to man are illustrated. The film includes close-ups of the enemy in action and shots of the devastation wrought by these often beautifully-coloured creatures. Only organized control can master the rival world, and there are dramatic sequences throughout, particularly those taken from a plane while flying through a swarm of locusts during spraying operations. The director, Bert Haanstra, and Shell's chief cameraman, Sidney Beadle, and their assistants, are to be congratulated on producing a film brilliant both in its conception and in the craftsmanship of its production.



A Shell photo

Praying Mantis from the film The Rival World.

Industrial Lubrication

Recently the Vacuum Oil Company and its European associates in France, Germany, and Italy decided to establish an Industrial Film Library to contain films suitable for exhibition in all European countries. The first three of these films were shown recently in London and deal respectively with lubricating greases, cutting oils, and thin film lubrication. The films follow the same general principle throughout, indicating the uses to which the various types of lubricants are put, explaining the basis for their correct selection, and showing how important it is for the correct manufacturing procedures to be followed under carefully controlled conditions. Where necessary animated diagrams are employed to illustrate the benefits of correct lubrication, and throughout each film the commentary is lucid and not marred by any background music.

The films are in monochrome and each one lasts about 30 minutes. They can be borrowed direct from Vacuum Oil Company Ltd, Industrial Sales Department, Caxton House, Tothill Street, London, S.W.1.

Belgian Grand Prix

The period of the London Motor Show is always the occasion for Shell-Mex and BP Ltd to arrange the première of a new motor racing film. This year was no exception and the film released was a half-hour account of the 1955 Belgian Grand Prix. Opening with views of the famous Circuit National de Francorchamps in its normal everyday appearance, the subsequent sequences of the race were a strong contrast, with the noise and hustle of practice, preparation, and race. Although at no time was the result of the race in doubt—Fangio won at an average of 118·84 m.p.h. in a Mercedes, with Stirling Moss second in a similar car—there were many exciting moments which were caught by the cameracraft of the ten operators stationed around the 9-mile circuit. The film, which is a joint production of the Shell Film Unit and the Belgian Shell Company S.A., is available on loan on application to Shell-Mex and BP Ltd.

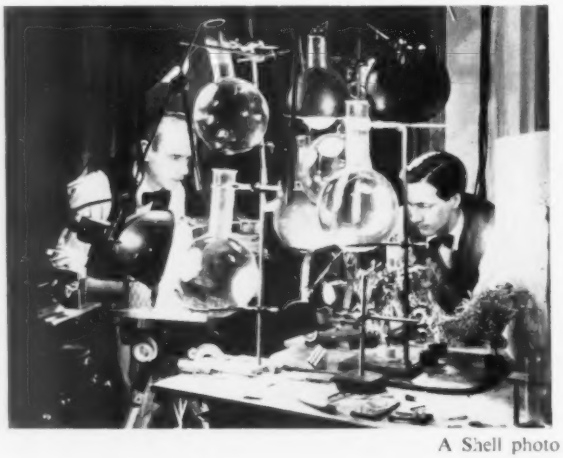
U.K. Petroleum Statistics

Full statistical data regarding the petroleum industry are obtainable from the latest (1954) issue of the "Ministry of Fuel and Power Statistical Digest" (HMSO £1 5*s* 0*d*). Supplies of imported crude and products are detailed for the period 1920-54 and refinery throughputs and outputs are covered for 1938 and 1947-53. In regard to home consumption, deliveries of all products are given for 1938 and 1947-54, and in two-monthly periods for 1953 and 1954. The uses of liquid fuel during the seven years 1948-54 are analysed by industries, by regions, and by types and main industries for two-monthly periods. Inland deliveries of gas-diesel and fuel oils are analysed for 1938 and 1946-54. Details are also given concerning the shale oil industry and overseas production by British and British-Dutch companies.

Particulars of motor benzole are set out in a section of the book and, in the gas and electricity sections, information is given regarding amounts of petroleum utilized.

World Oil Map

The latest (1954) edition of the Petroleum Information Bureau's map of the world's oil industry has just made its appearance. It shows the location of the centres of crude oil production and petroleum refineries throughout the world, and indicates by symbols the approximate capacity of each. Detailed tables are given for each country, showing individual capacities in metric tons, and some indication is given of main oil movements between continents for the same year. The price of the map is 2*s*. post free and application should be made to the Petroleum Information Bureau at 29 New Bond Street, London, W.1.



A Shell photo

Studio or laboratory? Water is used to cool high-intensity lights in close-up filming of insects for The Rival World. *Sidney Beadle and R. Whitehouse, one of his assistants, working under trying conditions.*

W. F. Jelffs, the new chairman

Twenty-five Years of Measurement Standardization

H. Hyams, the retiring chairman

A Record of International Co-operation

Throughout the 25 years of its existence the activities of the Institute's Standardization Sub-Committee concerned with the standardizing of techniques and procedures used in the measurement of bulk quantities of oil have been characterized by its devotion to international co-operation and agreement in this particular sphere. Without any doubt, notable success has been achieved.

It was in 1932 that James Kewley, then President of the Institute, said in his presidential address:—

> "There is much need for clarity on the subject of the fundamental units and their inter-relation, and of the physical constants used for the measurement of oil in bulk. That there is much confusion on this important subject appears from a perusal of the numerous books dealing with the matter . . . There is, moreover, no definite statutory authority for the figures used for conversion of volume to capacity in the Imperial system . . . an accurate, or at least generally agreed, figure is certainly desirable."

A short while before the above presidential address, Mr Kewley had initiated the setting up of a section of IP Standardization Committee to study the whole subject of oil measurement standardization. He became its first chairman, the other members being J. E. Hackford, H. Hyams, W. F. Jelffs, P. Kerr, H. Moore, V. Stott, J. McConnell Saunders, and Dr F. B. Thole.

In 1932 the Sub-Committee published the first section of its work in the form of a small volume entitled "Measurement of Oil in Bulk—Part I, Standard Weights and Measures". In the preparation of this book a considerable amount of international agreement had already been attained, since the Preface records that co-operation had been received from the Standards Department of the Board of Trade and from the National Physical Laboratory in Great Britain, from the Bureau of Standards in the United States, and from the International Bureau of Weights and Measures in Paris. Apart from providing statutory and nationally recognized definitions of standard units of measure with which the oil industry is concerned, the booklet contained a valuable table showing the inter-relation of units of measurement and recommended contracted ratios (these factors subsequently received the blessing of the API and have since obtained world-wide recognition). An important contribution to this IP book on weights and measures was an article by H. Hyams on the history of the standard units of weights and volume of concern to the oil industry.

From the very outset, co-operation between Mr Kewley's committee and an ASTM committee working in a similar field became close and fruitful. There was of course a slowing down of the collaboration work between the two committees during the war years but even during that period much useful work was done on this side despite war-time difficulties. Mr Hyams succeeded Mr Kewley as Chairman of the Committee in 1940 and in 1943 the Committee was completely remodelled and became known as Standardization Sub-Committee No. 1. In the meantime, in 1941, the Sub-Committee published a report covering the results of a thorough study of the thermal expansion of 179 different petroleum products. In 1944 a carefully prepared document "Principles Governing Oil Measurement Procedure" was prepared by Mr Hyams' Committee and, being subsequently blessed by ASTM, was published in 1945 in identical terms both by IP and ASTM.

In 1945 the Institute also published on behalf of the Sub-Committee a valuable volume "Tables for Measurement of Oil". This publication established authoritative tables for use in the United Kingdom and the British Commonwealth similar to and in line with those used in the United States and published by the U.S. Bureau of Standards as Circular C410.

The guidance given to the oil industry on oil measurement standardization was continued with the appearance of two pamphlets. In 1945 the Sub-Committee submitted recommendations on the best methods and apparatus to use in measuring accurately the level and volume of petroleum liquids in storage tanks; and in 1948 it recommended procedures for the calibration of vertical cylindrical storage tanks.

During visits to the United States in 1945-6 Mr Hyams took the opportunity of furthering the co-operative work by having detailed discussions on outstanding oil measurement standardization problems with his opposite numbers in ASTM. This was followed by a visit to the U.K. in 1948 by L. C. Burroughs and J. G. Detwiler as representatives of ASTM Committee D-2. They attended various meetings of Sub-Committee No.1 and its panels, the main outcome of which was the decision to recommend the publication jointly by ASTM and IP of a comprehensive set of volumes of oil measurement tables to cover British, American, and metric units of measurement. The recommendation was warmly

(Above left) *Among those present at the lunch to H. Hyams were* (left to right) *P. Kerr, B. C. Ferguson, H. Holmes, M. H. Hoffert, with their guest.*

(Above right) *E. Herbert, R. C. Porten, H. Hyams, P. Dribbell, W. G. Dawson.*

(Right) *F. L. Garton, A. T. White, P. Kerr, J. G. Appleton, P. Dribbell, W. L. Coats, H. Holmes.*

approved on both sides and was followed in 1949 by a conference in Brussels at which the needs of countries based on the metric system were noted and agreement reached on the basis of compilation and the content of the metric volume.

Thus, in 1952, after three years of strenuous co-operative work between IP and ASTM, during which further personal discussions took place in London and New York, the first two volumes of the joint ASTM IP Petroleum Measurement Tables appeared—those covering British and American units. The third volume for use in metric countries was published in 1953. In June, 1955, Technical Committee No. 28 (Petroleum Products) of the International Organization for Standardization unanimously agreed to recommend the ASTM IP Tables as a draft international standard.

Coincident with the work by one panel on these important tables, other panels were busily engaged on their respective subjects, and thus there appeared in 1952 "IP Petroleum Measurement Manual". This book of standards covers recommended techniques and equipment for adoption in all the sections which go to make up the measurement of a bulk quantity of oil—calibration of tanks and computation of tank capacity tables; measurement of oil volumes; sampling; determination of specific gravity and density; measurement of temperature; and calculation of volumes and weights.

In addition to the work which has been published in the form of books, reports, and pamphlets, members of Sub-Committee No. 1 have contributed considerably to the literature on oil measurement and have read papers on this subject at the last three World Petroleum Congresses as well as before scientific and technical societies. The Sub-Committee is also responsible for the specific gravity, water and sediment, water, and sampling methods which are published in the annual volume of IP Standard Methods.

The above is but a brief outline of the achievements over 25 years of this Oil Measurement and Sampling Standardization Committee. It serves to indicate, however, that the Committee has gone far towards the achievement of one of its primary objects—assistance in the elimination of sources of dispute in domestic and international transactions between buyer and seller where bulk oil quantities are concerned.

The Chairman Retires

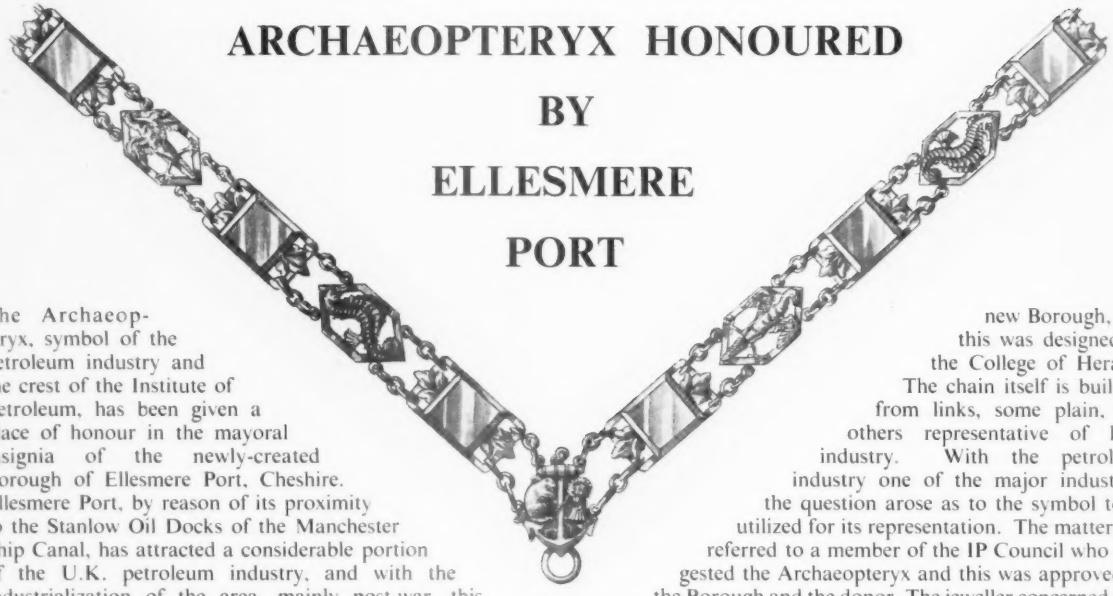
As mentioned before, H. Hyams has been chairman of the Sub-Committee since 1940 but, in October last, he found that commitments in other directions and a change in interests made it impossible for him to continue in that capacity. Therefore, to the regret of all concerned, he tendered his resignation but indicated that he would be willing, whenever called upon, to give his assistance in the work of the Sub-Committee.

W. F. Jelffs, a member of the Sub-Committee since its inception and its deputy-chairman for many years, was unanimously elected the new chairman.

In appreciation of his services as their chairman, members of the Sub-Committee recently entertained Mr Hyams to a luncheon in London. At this luncheon W. F. Jelffs proposed the health of their guest and expressed their appreciation of the tremendous amount of work which he had undertaken as their chairman and their pleasure in serving under him. Mr Hyams, he said, had never spared himself in the cause of oil measurement standardization and particularly in his efforts to secure the closest possible agreement with our American friends on this subject. They were all pleased, he said, that Mr Hyams would still be available to help them in the tasks which were still before them.

Mr Hyams thanked his colleagues for their good wishes and said that it had been a real pleasure to work with them. Oil measurement was a subject in which he had always had great interest. Although he would no longer be their chairman his interest in their deliberations would not wane and he assured them that as far as he was able he would always be at their service.

ARCHAEOPTERYX HONOURED BY ELLESMERE PORT



The Archaeopteryx, symbol of the petroleum industry and the crest of the Institute of Petroleum, has been given a place of honour in the mayoral insignia of the newly-created Borough of Ellesmere Port, Cheshire.

Ellesmere Port, by reason of its proximity to the Stanlow Oil Docks of the Manchester Ship Canal, has attracted a considerable portion of the U.K. petroleum industry, and with the industrialization of the area, mainly post-war, this Urban District has increased its population sufficiently to qualify for Borough status. An application for this was granted and the Royal Charter was presented to the new Borough of Ellesmere Port by Her Royal Highness The Duchess of Kent on 7 May 1955.

Borough status brought with it a requirement for all the insignia of office which goes with this higher standing. As of custom the insignia is presented by local industry. The Mayor's insignia consists of a chain carrying a jewel. The latter contains as its main motif the coat of arms of the new Borough, and this was designed by the College of Heralds. The chain itself is built up from links, some plain, and others representative of local industry. With the petroleum industry one of the major industries, the question arose as to the symbol to be utilized for its representation. The matter was referred to a member of the IP Council who suggested the Archaeopteryx and this was approved by the Borough and the donor. The jeweller concerned with the fabrication of the chain considered it a fitting design, both as a design and because of its College of Heralds' status. Application was made by the Borough to the Institute of Petroleum for the utilization of the Archaeopteryx design and this was granted.

As a result, the Mayor's chain, which is of solid gold, has two links depicting the Archaeopteryx as a symbol of the petroleum industry.

The chain was presented to the Borough by its donors on 30 August 1955.

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ROAD DEVELOPMENT—A NATIONAL INVESTMENT

F. A. C. Guépin, Vice-Chairman of the International Road Federation and a managing director of the Royal Dutch Shell Group, speaking recently at the Second World Meeting of the Federation in Rome, said that the most striking economic fact about road development in the last 20 years was its failure to measure up to the needs of an expanding world economy. In almost every country the economic and social implications of this failure were striking and in the more developed countries had resulted in waste on a staggering scale.

Good roads brought great benefits through reduction of transport costs resulting from the saving of time and fuel, less tyre wear, fewer accidents, and lower maintenance and repair costs. The automobile industry provided trucks capable of cruising speeds of 40 m.p.h., but users had to be satisfied with an average operational speed of 15-20 m.p.h. In London the bus takes longer than its horse-drawn predecessor.

"There can be no doubt any longer", said Mr Guépin, "that improved roads bring increased national prosperity". The nation was not called upon to *spend* its resources on roads but to *invest* them. An outlay of £250,000 per mile would bring savings of as much as £25,000 per mile per year. That was a fair return for investment and was immediately reflected in national productivity and national prosperity. The countries which between them accounted for 90 per cent of the world's vehicles and 75 per cent of the highway mileage spent only 1·3 per cent of their national income on roads in 1953. That was expenditure not investment.

Mineral White Oils and Sulphonates*

By T. F. BROWN† (*Fellow*)

Introduction

The petroleum refining industry which has developed in the U.K. during the past 20 years has been dependent to such an extent on advanced American techniques that we are apt to forget that some of the primary refining operations originated on this side of the Atlantic. James Young laid the foundations of petroleum distillation, Edeleanu pioneered solvent extraction, while Americans and Russians are in substantial agreement that the production of white oils by oleum refining of lubricating oil fractions was developed by Russian chemists, Markownikoff and Petroff.

While it is true that modifications in distillation and solvent extraction techniques have kept pace with other refining developments in the U.K., the technology of white oil production has not altered basically in the past 20 years and the annual U.K. production of 15,000 tons is still produced by attacking selected lubricating oils with large doses of oleum. This operation leads to considerable losses of acid in the form of sludge. For example, in the treatment of 1000 tons of oil one might expect to lose 125 tons of the oil and 500 tons of oleum as sludge. Approximately 5 to 6 per cent of the oil and 2 to 3 per cent of the oleum would normally be recoverable as by-product sulphonates.

There have, therefore, existed considerable technical and economic incentives to improve the established methods of manufacturing white oils. The primary chemical reaction involved is sulphonation and as a result of improvements in the technology of sulphonation of petroleum hydrocarbons, largely originating in the U.S. following the development of petroleum-based detergents, corresponding improvements may now be expected in white oil and petroleum sulphonates manufacture. The present discussion will, however, be limited to the process as currently operated.

Commercial Production

Of the total U.K. production of white oil approximately 47 per cent consists of medicinal paraffin, the remainder being technical white oil grade. The estimated by-product 40 per cent sodium sulphonate production resulting from these operations is only 2500 tons per annum of all grades and to meet current requirements for engine additives alone oil companies are importing by-product sulphonates from America and the Continent. Here again there is considerable scope and incentive to augment the U.K. production of sulphonates by methods preferably not tied to white oil production. In the white oil manufacturing process the by-product can command a price comparable to or greater than that of the main product. This is a very happy state of affairs and a chemical engineer's life would be a lot easier if all processes were similarly twice-blessed. New processes for sulphonate production divorced from white oil manufacture would not be so economically attractive.

Technical Aspects of Manufacture

As an indication of the objective of the refining operations involved in manufacture of white oils, some typical inspections of these products are reproduced in Table I.

In addition to the commoner grades specified in Table I there is a medium-grade liquid paraffin (W.A.2) and medium (W.A.21) and heavy (W.A.20) grades of technical white oil.

The lubricating oil fraction selected for manufacture of specific grades is, therefore, mainly governed by the viscosity specification. Thus, in the manufacture of W.A.1 (heavy) grade liquid paraffin a light engine vacuum distillate is normally selected and for light technical white oil, a light spindle vacuum distillate. These distillates are then submitted to a solvent extraction treatment to remove part of the aromatic petroleum hydrocarbons which would otherwise be degraded to additional sludge on subsequent contacting with oleum in either two or three cycles. Technical white oils are less heavily refined with oleum than liquid paraffin grades as there is no B.P. specification to meet in this case.

TABLE I
INSPECTION OF THREE GRADES OF WHITE OIL

White Oils Association No.	W.A.1	W.A.3	W.A.23
Grade	Heavy liquid paraffin	Light liquid paraffin	Light tech. white oil
Density, 20° C	0.8888	0.8620	0.8650
Refractive index n_D^{20}	1.4830	1.4710	1.4720
Viscosity at 20° C, cS	258	30.3	30.3
(100° F) 37.8° C, cS	78.3	15.4	15.4
(210° F) 98.9° C, cS	7.69	3.3	3.3
Aniline point, °C	104.4	97.0	96.0
Colour, Saybolt	+30	+30	+30
Carbonizable substances test B.P. (Colour of acid layer)	2.8Y 1.3R (good pass)	3Y 1.6R (good pass)	3-ASTM (fail)

Schematically the steps in the production of white oils or liquid paraffin from crude oil are as shown in Figure 1.

The removal of aromatics from the distillate is an essential feature of white oil manufacture but it does not follow that when all the aromatics are removed the oil will meet the B.P carbonizable substances specification for liquid paraffin. This point is illustrated in Table II which shows the extent

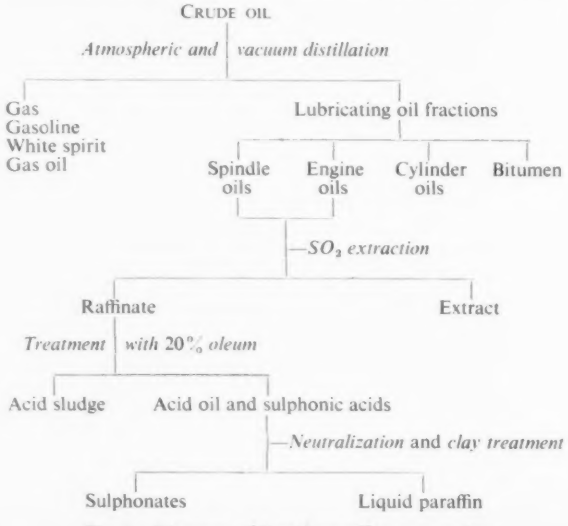

Fig. 1. *Diagram of liquid paraffin preparation*

*Paper read to the Institute of Petroleum, London Branch 22 March, 1955.

†Lobitos Oilfields Ltd.

TABLE II

PROPERTIES OF OIL AT VARIOUS STAGES OF TREATMENT FOR W.A.1 LIQUID PARAFFIN

	Distillate	*Solvent refined raffinate*	*1st cycle neutral oil*	*2nd cycle 1st stage neutral oil*	*2nd cycle 3rd stage neutral oil*
Density 20° C	0·9183	0·9041	0·8908	—	0·8888
Refractive index n_D^{20}	1·5046	1·4940	1·4845	—	1·4830
Viscosity at 20° C cS	542	401	288	—	258
Aniline point °C	85·2	94·4	103·6	—	104·4
Colour Saybolt	—	—	+22	—	+30
Carbonizable substances test B.P. (colour of acid layer)	—	—	8 + ASTM	—	2·8Y/1·3R
Aromatics °/o w/w	30·0	16·0	3·0	1·0	Nil

of aromatic removal at various stages in the refining procedure for W.A.1 liquid paraffin. The B.P. carbonizable substances test is specified at 6.5Y/2.5R maximum.

It will be observed that very little aromatic removal is accomplished in the second cycle of oleum treatment. The oleum treatment in the first cycle based on aromatics is approximately 180 per cent wt/wt, while in the second cycle it is 1000 per cent wt/wt. The additional oleum in the second cycle is involved in oxidation reactions such as the dehydrogenation of unstable naphthenes and a certain amount of sulphur dioxide and carbon is produced in these reactions.

Further evidence of the extent of aromatic removal at various stages is provided in Table III by the u.v. spectra of the neutral oils. The u.v. spectrum measured between 2400 and 2900° A gives a good impression of the aromatic content of petroleum oils. The average level of absorption indicated by the spectrum is proportional to the aromatic content of the oil, as indicated in Table III. The degree of reduction of absorption at various stages in the manufacture, represented in this way, is quite remarkable.

Apart from the wastage of oleum to sludge formation in the first cycle there is, therefore, also a large expenditure of oleum in the removal of the final traces of aromatics and in the oxidation of naphthenes and other side reactions in the second or third cycles. There is thus considerable scope for improvement in the oleum economy in the second or third cycles of the process.

Oleum Treatment Stage

In continuous equipment the oleum treatment of a specific raffinate for liquid paraffin production is carried out in such a manner that close control of the following variables is obtained: Oil to oleum ratio, contacting efficiency, reaction

TABLE III

U.V. SPECTRA DATA (W.A.1 MANUFACTURE)

Stage of Manufacture	*Average absorption level* ($E_{1cm}^{1\%} \times 500$)	*Average percentage reduction per stage*
Original distillate	35,000	0
Solvent extracted raffinate	15,000	57
1st cycle oleum treatment	200	42
Liquid paraffin B.P.	1	Less than 1

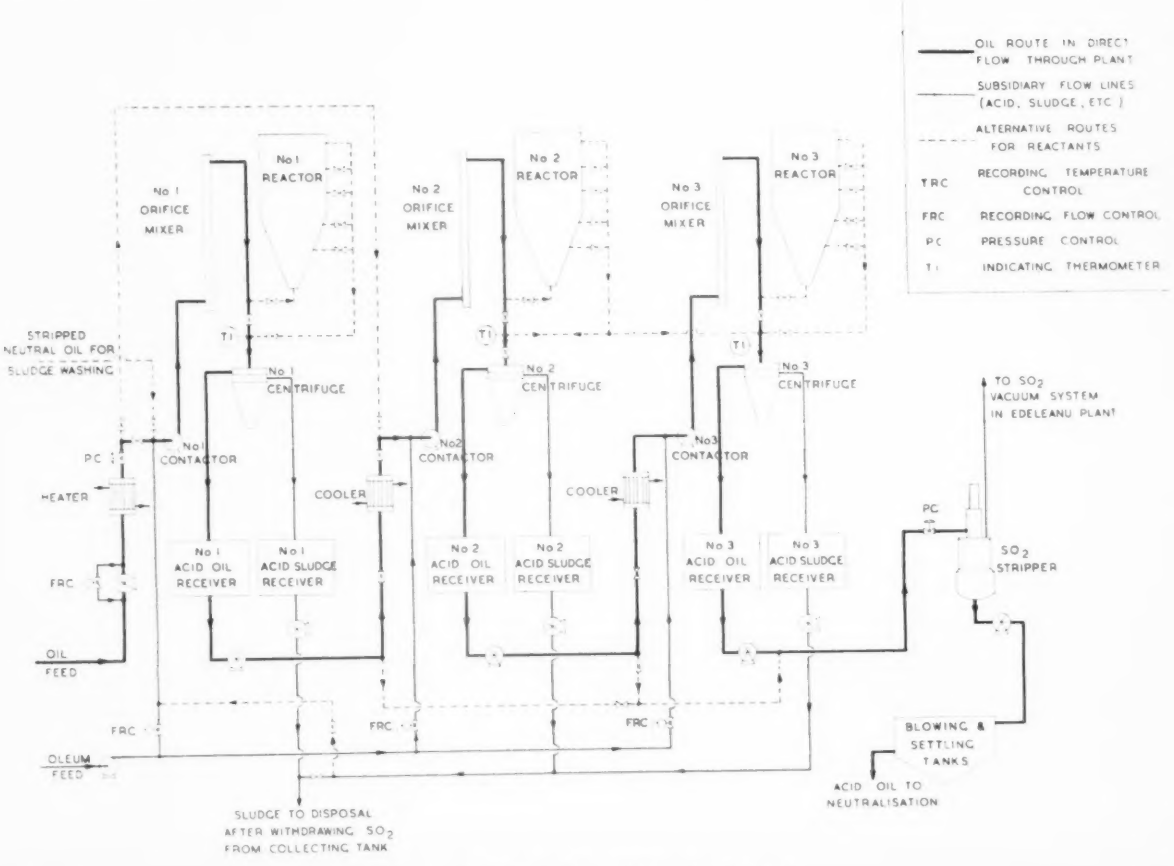

Fig. 2. Flow diagram of acid treating (W.A.1)

temperatures, reaction time, and efficiency of acid–oil phase separation. These variables are considered in detail below. See also Figure 2.

Oil to Oleum Ratio

Initial laboratory development work on a continuous basis indicated that an overall treatment of 60 per cent weight 20 per cent oleum would be required for Peruvian raffinate oil and the efficiency of this treatment was optimum when the oleum was applied in lots of 10 per cent. However, it was also found that when this system was used the later additions of oleum reacted with sulphonic acids formed in earlier stages to the detriment of the yield of sulphonic acids. The quality and yield of the sulphonic acids could be improved and the oleum requirement reduced if the acid oil was neutralized after, say, three treatment stages of 10 per cent of oleum. Oleum consumptions of 45—55 per cent 20 per cent oleum are obtained in current practice. The oleum can be applied in either two or three cycles, each of three stages with inter-cooling between stages.

Oil and oleum flows are on flow recorder control, the oil flow which is preheated being pumped against a constant pressure control valve which keeps the oil above the steam pressure to prevent contamination of the oil stream in case of heat exchanger leakages.

Contacting Efficiency

The oil and oleum streams are pumped through orifice mixers at each stage before entering a centrifuge via reactor vessels. These orifice mixers consist of twelve orifice plates containing $\frac{1}{2}$-inch-diameter holes and the combined oil–oleum is circulated by means of a Sigmund single-stage centrifugal pump delivering 1000 g.p.h. at 1460 rev min and 30 ft head. Poor mixing efficiency may lead to under-treatment or over-treatment of the oil, depending on time of contact of each parcel of oil.

Reaction Temperature

The reaction is controlled at an average temperature (at the centrifuges) of 50° C by manual control of the stream flow to the oil pre-heater. Temperatures between 0° and 50° C have no effect on the yield and quality of the resulting white oil or liquid paraffin, provided the intensity of oleum treatment is the same. At low temperatures, however, the solubility of the sulphonic acids in the oil phase is reduced and this results in reduced yields of sulphonates unless special measures are adopted to improve recovery, whereas at high temperatures (above 50° C) some acid decomposition products may revert to the treated oil and render it unstable.

Reaction Time

Reaction time can be varied at each stage by means of reactors, which are cylindrical vessels $9\frac{1}{2}$ ft × 4 ft dia with additional conical bases. These vessels have take-off lines at various levels which can give residence times of two minutes to one hour. The optimum reaction time is ten minutes and includes the time from the point of mixing to the separation in the centrifuge. Prolonged reaction times tend to produce the same effect on sulphonate yield as repeated-stage oleum treatment without neutralization.

Efficiency of Acid–Oil Separation

The emulsion is separated by means of high-speed centrifuges operating at 40—60° C. There is one centrifuge attached to each stage but these can be operated either in series or parallel and, therefore, admit some flexibility in the amount of oleum used in each treatment stage and also in the number of stages. This arrangement also permits counter-current flow of oleum and oil in each cycle as used in the processing of lower viscosity raffinates in the manufacture of technical white oil.

The inorganic acidity of the oil leaving the centrifuge is used as a control on the separation efficiency. Obviously, the less inorganic acid remaining in the oil the less load is placed on the subsequent neutralizing and desalting stages.

Neutralization Stage

Prior to neutralization the treated oil is also stripped of sulphur dioxide, formed during the oleum treating stages. This operation is carried out in a vacuum flash evaporator operating at 26—29 inches mercury and 120° F. The neutralization step is mainly influenced by the following variables: composition of the neutralizing liquor, ratio of neutralizing liquor to oil, temperature of phase separation and efficiency of contacting and separation.

Composition of Neutralizing Liquor

Neutralization is normally carried out with an aqueous alcoholic lye rather than with aqueous alkali. In this way emulsions are avoided if the correct conditions are used and a 100 per cent extraction of neutral sulphonates is obtained in the aqueous alcohol phase.

The composition of the neutralizing liquor will depend to some extent on the total acidity present in the oil but a typical composition is caustic soda 5 per cent wt, alcohol 30 per cent wt, and water 65 per cent wt. When the total acidity is very low a more dilute solution in respect to caustic soda is preferable, otherwise insufficient alcohol phase would be present to give a good separation. It is generally desirable that the ratio of extract to raffinate phases should be in excess of 0.4 by weight.

Ratio of Neutralizing Liquor to Oil

This is also governed by the total acidity of the oil, neutralizing liquor flow being preset to produce a pH of about 8 in the oil–liquor emulsion.

Temperature of Phase Separation

There is very little difference in the equilibrium curves for the multi-component system, oil–sulphonic acids–neutralizing liquor, in the temperature range 25 – 65° C. Plant practice is to heat the neutral mixture to 60° C to promote clean separation of the phases in the centrifuge.

Efficiency of Contacting and Separation

The plant required for the neutralization step (Figure 3) is rather similar to the oleum contacting equipment but the operation is carried out in one stage. The acid oil and neutralizing liquor are pumped under flow control to a similar pump and orifice plate assembly without preheat. The emulsion is heated to 60° C using temperature control on the steam circuit and centrifuged in a machine.

Separations of sodium sulphonates from the oil which approximate to the theoretical are possible using this method. Oil associated with the extracted sulphonates is kept to a minimum if the extract–raffinate ratio of the phase is properly adjusted as described above. This may not be considered important when it is stated that the final sulphonates product is sold in solution in oil (40–60 per cent) but normally the blend is made with a less valuable, less viscous, oil product than white oil.

Spent lye is continuously circulated to an alcohol recovery system, (Figure 3), consisting of a steam preheater (to 100° C), a single-stage steel tube and shell flash evaporator (125 sq ft) and a distillate receiver, from which the cooled dilute alcohol is returned to storage and recycled to process.

Alcohol is removed from the oil in a vacuum evaporator.

Finishing Treatments for White Oils and Sulphonates

Clay Treatment of White Oils

After neutralization of the acid white oil, separation of the alcoholic lye and oil phases, and removal of traces of alcohol,

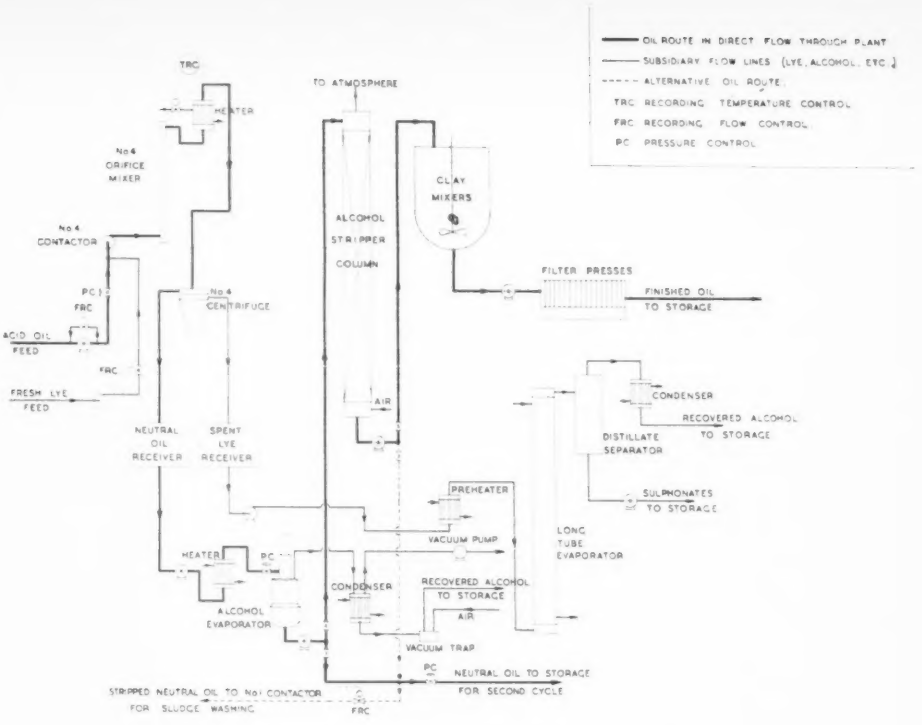

Fig 3.
Flow diagram of neutralization (W.A.1)

the oil is contacted with 2–4 per cent of acid activated clay at 75° C for 1½ hours to remove the last traces of sulphonates and moisture. The clay is removed by filter press.

Sulphonate Desalting and Blending

On leaving the bottom of the alcohol flash evaporator vessel, crude W.A.1 sulphonates have the following approximate composition.

	%
Sodium sulphonates	40–50
Sodium sulphate	15–10
Oil	5–10
Water	40–30

Since this product is normally sold as a 40–60 per cent concentrate of sodium sulphonate in oil or as a 30 per cent concentrate of calcium sulphonate in oil with a minimum concentration of sulphate (less than 3 per cent), the soap content has to be adjusted by adding a neutral oil and considerable desalting has to be undertaken. The desalting is done by adding industrial alcohol to the crude sulphonate mixture at 60° F, the precipitated sulphate being removed by filtration and the alcohol recovered. Adjustment of the soap concentration is made after desalting by adding 150 neutral oil.

Typical analyses of finished sulphonate blends are given in Table IV.

Materials of Construction

Vessels

All vessels and lines are of mild steel without lining as the colour of the oil is unaffected and that of the sulphonate by-product relatively unimportant. Lines carrying the final oil product (after clay treatment) are partially constructed in glass, mainly to avoid picking up traces of rust prior to packaging. Distribution is made in new steel drums or by steel tank cars reserved for this market. Slow corrosion is observed in acid sludge and spent alkali run-down tanks, which are also of mild steel.

Heat Exchangers

These are again all of mild steel construction.

Pumps

Oleum handling is by high nickel chromium (R.55) alloy centrifugal pumps with oil-sealed stuffing boxes. These have given excellent service. Sludge pumps are of stainless steel and the glands require constant attention. Oleum–oil emulsion circulating pumps have cast-iron casing carbon steel shafts with stellited sleeves and impellers of ½ per cent Cr., 2 per cent Ni. cast iron. The Sigmund pumps on neutralization service have a stainless steel shaft and impellers with stellited sleeves.

TABLE IV

INSPECTION OF SODIUM AND CALCIUM SULPHONATES BY ASTM D.855

Property	*Inspection*	
	Sodium	*Calcium*
Soap content	41.8	29.4
Mineral oil	54.0	69.3
Molecular weight	465	1020
Inorganic salt	0.50	0.10
Sodium carboxylate	0.37	—
Sulphated ash	7.7	4.4
Alkalinity (NaOH)	0.10	0.11
Water	3.2	1.1
Specific gravity at 60 F/60 F	1.02	0.94

Centrifuges

The centrifuges separating acid sludge from oil are constructed with bowls and covers in stainless steel (18 per cent Cr., 8 per cent Ni., 3 per cent Mo.) and corrosion rates are relatively low. The bowls are disk type, the life of a stack of

disks being about three years. After five years operation, replacement of certain other bowl parts has become necessary.

Criteria of Purity and Stability of Liquid Paraffin

Some indication of the empirical nature of the white oil process and the lack of progress over the years may be derived from the fact that the main B.P. test of purity is essentially the same as it was in 1898. The present day test is, if anything, less stringent. The test consists in measuring the colour of a 96 per cent sulphuric acid layer which has been shaken under standard conditions with the white oil sample. The test is only useful as an indication of the presence of traces of impurities which would not be detected in a normal colour measurement. Indirectly, it also gives an indication of the extent of oleum refining but in modern practice measurement of the u.v. spectrum of the oil provides a much more accurate indication of this. Fluorescence in ultra-violet light is also used to detect traces of contaminating oil impurities.

Since the main problem associated with the manufacture of liquid paraffin is the achievement of a satisfactory stability to light and heat and since no criterion is provided in the B.P. specification, it has been necessary to develop more or less empirical tests which correlate with light or heat stability for plant control purposes. None of the tests so far published is satisfactory.

There are several types of reaction which can occur during the exposure of a medicinal paraffin to light or heat. A distinction is normally made between "light stability"—the resistance of an oil to deterioration when stored in clear containers under such conditions that it is exposed to strong light, including direct sunlight, and "shelf life", the resistance of an oil to deterioration when stored in containers, including clear glass bottles, under such conditions that it is not exposed to direct daylight or to temperatures greatly in excess of normal room temperature. Exposure to direct sunlight and resulting elevated temperatures will lead to cracking and polymerization in addition to oxidation reactions. Shelf exposure should only result in oxidation. It is, therefore, claimed by Golden, (*J. Amer. Pharm. Ass.*, 1946, **35**, 76) that there is a correlation between the peroxide test value (*i.e.*, number of minutes at 150° C to formation of detectable peroxides) and shelf life, as follows:

TABLE V

SHELF LIFE AND PEROXIDE TEST

Peroxide Test Value Minutes	*Approximate Stability Months*	*Shelf Life*
1 and 2	1 to 2	Poor
5	6 to 8	Fair
10	10	Good
15	12	Good
20 and over	Greater than 24	Excellent

The shelf life or peroxide test value does not necessarily give any indication of light stability. Several other accelerated oxidation tests (heat stability) have been suggested but are of doubtful value, apart from assisting to maintain a constant level of quality, as they do not correlate with exposure to sunlight.

Sunlight exposure tests are prolonged and are not capable of accurate interpretation. They are, therefore, not suitable for plant control. However, they are the only means of making final assessments of the stability of finished oils. Attempts have been made to reduce these tests to a more accurate basis by using a sunshine recorder and converting all readings to hours of June midday sun. This eliminates to some extent the vagaries of English weather and climatic conditions. The total hours of "daylight" exposure may still, however, vary considerably from sample to sample, depending on the time of year. Oil failure is assessed by odour and even when using a panel of experts for this purpose, it is still an unsatisfactory criterion.

Sunlight lamps, such as the G.E.C. R.S. lamp, show possibilities for use in accelerated sunlight exposure tests when used at elevated temperatures but the odour assessment is still the unreliable part of the tests. Recent work has, however, indicated a correlation between the point of odour failure, the development of colour, and the increase of u.v. absorption level.

Inhibitors in Medicinal Oils

Till recently it was required that medicinal oils should be pure petroleum products free from added non-hydrocarbon material. In 1950, however, the U.S. pharmacopœia permitted the addition of tocopherol, up to a maximum of 10 p.p.m., to liquid paraffin as a stabilizer. This addition was incorporated in the B.P. in 1953.

Tocopherol shows to advantage in the inhibition of oxidation reactions such as are encountered in ordinary shelf exposure and in accelerated tests such as peroxide test value and stability to oxidation at 100° C in absence of sunlight. Amounts of the order of 1–2 p.p.m. are adequate for this purpose and at this level do not have any adverse effect on sunlight exposure tests.

Detection of tocopherol at this level is almost impossible directly. However, its presence can be inferred if an oil has a peroxide test value of 20 or greater, a good stability to oxidation at 100° C, and good sunshine stability.

Other edible oxidation inhibitors are even more effective in improving shelf life and heat stability than tocopherol but sanction for their addition has not so far been sought.

Solubility Characteristics of Petroleum Sulphonates

The sulphonation of petroleum hydrocarbons yields products of varying solubility, depending on the petroleum stock and the conditions of sulphonation. Thus only a portion of the sulphonate product is oil soluble. The remainder will vary in solubility through a range of intermediate solubility materials to water solubility. The water soluble sulphonic acid mixtures are usually green in colour and the oil solubles mahogany colour. There is normally a fairly good separation between these two main types, the green acids predominating in the acid sludge phase and the mahogany acids in the oil phase. If a large percentage of intermediate solubility material is present the separation will not be so complete.

It has been stated in the literature that the solubility is dependent on molecular weight. This is only true, however, for a specific aromatic nucleus and since the number and configuration of aromatic rings in lubricating oil molecules vary appreciably, the solubility of the sulphonate will be determined by the ratio of carbon atoms in the alkyl substituents to those in the aromatic rings. Reference to Figures 4 and 5 will assist in the interpretation of this statement. These figures were constructed from determination of solubility of sulphonic acids derived from miscellaneous lubricating fractions in the molecular weight range 300 to 450. For these fractions the molecular weights of oil-soluble sulphonates can vary between 400 and 550 and water solubility can be obtained at 470 molecular weight and higher. Figure 5 shows that the range of configurations of these oil fractions producing oil-soluble sulphonates is quite a small one. It shows that the aromatic nuclei are mostly of the naphthalene type, *i.e.*, a double ring corresponding to a carbon count of 10. For oil solubility the minimum side chain attached to the rings should be of 14 carbons but preferably 16. One or two synthetic alkyl aryl sulphonates have been plotted in Figure 5. Thus, dodecyl benzene yields a typically water soluble sodium salt and is the basis of the modern petroleum detergent

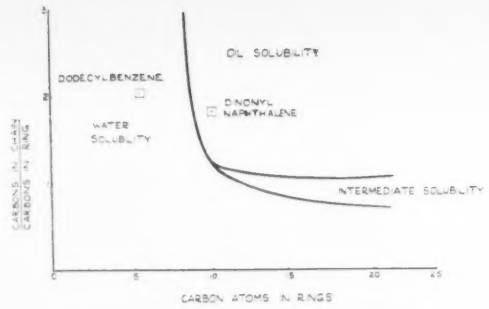

Fig. 4. Molecular structure and solubility.

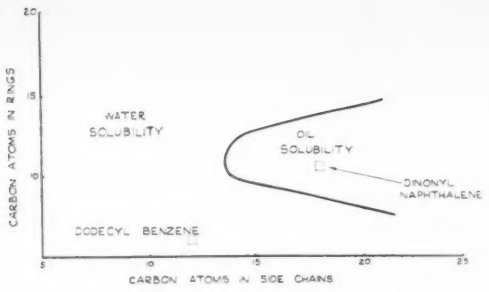

Fig. 5. Molecular structure and solubility.

industry. Dinonyl naphthalene on the other hand has been produced commercially for a synthetic oil-soluble sodium sulphonate. According to the chart, even didodecyl benzene should produce a water-soluble product. It is, however obtained as a by-product in the manufacture of dodecyl benzene in admixture with higher molecular weight fractions which yield an oil-soluble product on sulphonation and neutralization.

From these considerations it will be evident that the molecular weight of sulphonates by itself is no criterion of oil solubility. However, some companies still specify that their sulphonate deliveries should be in the range 450–470 molecular weight and leave it at that. Molecular weight would be a more reliable criterion in the 500 M.W. range, as it is unlikely that single ring aromatics from natural lubricating oils would have such an abundance of side chains to reach this molecular weight.

Applications of White Mineral Oil

Although the total white oil production is small compared with other petroleum products, it would appear that its applications are inversely proportional to its volume. Some fifty applications are listed and these vary from quartz cutting to candy manufacture.

However, distribution of white mineral oil products is largely made to the pharmaceutical industry (for cosmetic, toilet, and veterinary preparations) and to the food industry for the lubrication of machinery.

White oils are employed in the formulation of many different types of cosmetic products. They are used, for example, in cosmetic pastes and creams and in preparations for make-up, hair dressing, and manicure. An emulsion-type cleansing cold cream will contain 55 per cent and a non-emulsion mineral jelly cleansing cream 63 per cent of W.A.23 grade white oil. Other types of creams in which white mineral oil may be used are: vanishing creams, protective creams, hand creams, and brushless shaving creams.

White mineral oil is used as a base for hair preparations, particularly brilliantines, creams, and pomades, the content varying from 99 to 20 per cent.

Make-up preparations of cream consistency, *e.g.*, cream rouge, are formulated along the same lines as cosmetic creams. Preparations of harder consistency, *e.g.*, lipsticks, eyebrow pencils, paste rouges, etc., do not contain white mineral oil as they require greater concentrations of petrolatum and waxes.

In the food industry white mineral oil has been used for many years as a lubricant and rust preventive for processing machinery, as a slab oil to prevent foods from sticking to equipment, and as a float to control evaporation, mould growth, or fermentation. Table VI interprets the requirements to be met in the food industry for mineral white oil in terms of standard tests.

Applications of Oil-Soluble Petroleum Sulphonates

The extensive use of oil-soluble petroleum sulphonates in industry is due to the following four main functional properties: emulsification and dispersion of liquids, dispersion and wetting of solids, wetting and dispersion of liquid–solid systems, and inhibition of rust and corrosion. Table VII illustrates the wide diversification in the application of these materials.

TABLE VII

SOME APPLICATIONS OF OIL-SOLUBLE PETROLEUM SULPHONATES

Agricultural spray oils	Insecticide formulations
Alcohol anti-freeze	Leather finishing
Asphalt paving and roofing adherent	Lubricating oil addition agents
Cordage oils	Oil flotation processes
Crude oil emulsion splitting	Pigment dispersing
Cutting oils	Plastic dispersions } oil free
Dry cleaning soaps	Rubber dispersion } oil free
Emulsion polishes	Rust preventive compounds
Fat splitting	Solvent cleaners and degreasers
Fuel oil sludge dispersants	Textile oils

TABLE VI

PROPERTIES OF OILS USED IN THE FOOD INDUSTRIES

Requirements to be met by the Oil	*Requirements Expressed in Standard Tests*				
		Heavy	*Medium*	*Light Medium*	*Light*
It must have the viscosity required for the particular processing operation	Kinematic viscosity, cS at 100 F	65–80	14.5–21	11.5–14.5	7.2–10.5
It must flow freely at moderately low temperatures	Pour point F	25 max	25 max	25 max	25 max
It must not oxidize, sludge, corrode metal, or otherwise chemically react	Acid test	B.P.	B.P.	B.P.	B.P.
	Acidity	About 0.01 mgKOH/g		About 0.01 mgKOH/g	
	Sludge test (IP 56)	0.02–0.03%		0.02–0.03%	
	Sligh oxidation number	Below 1	Below 1	Below 1	Below 1
	Conradson carbon residue	About 0.005%	About 0.005%	About 0.005%	About 0.005%
It should readily separate from any water that may be present	Steam emulsion No.	About 10 sec.		About 10 sec.	
It must not impart colour, odour, or taste to the food being processed	Saybolt colour	+30 (water white)		+30 (water white)	
	Odour and taste	None	None	None	None
It must not develop colour or odour on standing	Peroxide test (shelf life)	Passes	Passes	Passes	Passes

The sulphonated products from petroleum obtained during refining, which were at one time waste products, are now perhaps the most important single class of petroleum products used in the manufacture of additives. A considerable proportion of the sulphonates thus used is incorporated as detergents in motor oils in the form of the calcium compound (neutral or basic). These additives are usually added in fairly small amounts governed by the amount of non-volatile ash left behind in the engine on combustion. It has been generally accepted that this ash (determined as sulphated ash) should not exceed about 0.25 per cent. On this basis, and assuming a sulphated ash of 5 per cent weight for the calcium sulphonates, the oil would contain a maximum of 5 per cent of the commercial calcium sulphonate. Recent work on the relationship between L4 bearing weight loss and the detergent content of the oil has shown that the curve (Figure 6) passes through a well-defined maximum at approximately 1 per cent

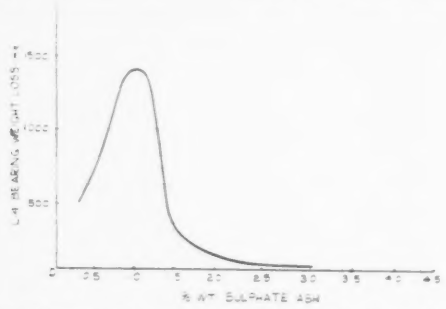

Fig. 6. Relationship between bearing weight loss and detergent content.

sulphated ash. Although some heavy duty oils in the United States incorporate large percentages of additives of various classes, even up to 20 per cent, these only partly consist of sulphonates and the applications of such oils are limited. Normally the basic calcium sulphonate is prepared for engine oil additives since this rapidly neutralizes the free acidity formed as a result of oil decomposition. It is also possible, of course, to reduce the tendency to acid formation by incorporating an additional anti-oxidant additive of the protected phenol or substituted aromatic amine type.

Calcium sulphonates of high molecular weight (1000) effectively reduce lacquer deposits on pistons by virtue of their detergent or scavenging action on carbon particles. For use as engine additives the calcium sulphonate is normally distributed as a 30 per cent concentration of soap in 150 neutral oil.

The use of sodium sulphonates as rust and corrosion inhibitors in lubricating oils is an application of their power to form stable, colloidal, water-in-oil dispersions which act as a moisture barrier absorbing the moisture before it attacks the metal. In this type of application, exemplified by sulphonate-inhibited turbine oils, the lower molecular weight sodium sulphonates in the range 400–450 are more suitable on account of their superior emulsifying properties. Similarly this molecular weight range finds application in cutting oils and in preparations for the scouring of textiles during processing.

Table VIII illustrates the superiority of barium over sodium sulphonates as rust inhibitors in petroleum. Owing to the shortage of by-product sodium petroleum sulphonates during the war synthetic materials such as sodium dinonylnaphthalene sulphonates were manufactured by alkylation of naphthalene, but in this particular application the by-product sodium mahogany sulphonates are superior. Of the two barium compounds the dinonylnaphthalene sulphonate is superior. These conclusions also apply to the use of such anti-rust inhibitors in synthetic oils.

The simplest type of emulsifier oil preparation consists of a 20 per cent solution of sodium sulphonates in mineral oil. In general this will not produce highly stable emulsions when diluted with water, but the emulsion stability may be sufficient for many uses. Soluble cutting oils usually consist of sodium petroleum sulphonates in mineral oil (100–200 visc SSU at 100 F) with small additions of a coupling agent to speed the emulsion formation or produce more stable emulsions (*e.g. iso*propyl alcohol, denatured alcohol, ethylene glycol, diethylene glycol or propylene glycol) and potassium resinate.

Caustic potash and oleic acid may also be added, the latter in sufficient quantity to produce a clear soluble oil. A typical preparation is as follows:

	Per cent by weight
Petroleum sulphonate	10
Commercial anhydrous potassium resinate	5
Coupling agent	1
20 per cent caustic potash	0.4
Mineral oil	83.6

As cutting oils are diluted with water before use the actual consumption of sulphonates in these applications is quite small.

One of the first treatments undergone by raw wool is the scouring process, which consists of macerating the sorted fibres with soap solutions to remove wool grease or lanolin. The function of the soap preparation is twofold; (*a*) it must have a solubilizing action on the grease and (*b*) it should be readily removed by subsequent water washing. The lower molecular weight sulphonates are most suitable for incorporation in these preparations. The wool fibres must be handled gently at this stage as wetting causes the fibres to curl and felt together. Agitation should be kept to a minimum. The raw wool is, therefore, fed in at a carefully controlled rate, pushed slowly through the scouring liquors by a series of forks, and passed from one tank to the next through rollers. The wool is finally rinsed in clear warm water.

Some applications of sulphonates require that the material should be free of oil, for example, in the emulsion method for the polymerization of synthetic rubbers and in plastic

TABLE VIII

RUST-INHIBITING PROPERTIES OF BARIUM AND SODIUM SULPHONATES IN PETROLEUM OIL

Fog Cabinet Corrosion Test Method at 120 F

Rust Inhibitor	*Active Ingredient Wt %*	*Hours before first rust*
None	—	1
Sodium mahogany sulphonate	2	48
Sodium mahogany sulphonate	3	48
Sodium D N N S	2	24
Sodium D N N S	3	32
Barium mahogany sulphonate	2	120
Barium mahogany sulphonate	3	168
Barium D N N S	2	168
Barium D N N S	3	216

dispersion processes. There is not much demand in the U.K. for this type of application at the moment but the residual oil associated with the sulphonates after the sulphonation and neutralization stages can be removed by partition between a light hydrocarbon solvent and an aqueous alcohol solution of the crude sulphonates. The solvents are subsequently stripped and recycled.

Future Prospects for the White Oil Industry

There is a steady market for liquid paraffin for medicinal purposes but it is likely that this market will shrink rather

Trade Literature, etc.

The Byron Jackson Company

The Byron Jackson Company of Los Angeles has been in existence for over 80 years, having been founded in 1872. Since that period it has served many industries with basic equipment and tools and in the petroleum industry has come to be known simply as BJ. Recently an illustrated booklet of nearly forty pages has been published to portray the achievements of the firm, and it is available on request to the Company at P.O. Box 2017, Terminal Annex, Los Angeles 54, California, U.S.A.

Automatic Liquid Scale

It is claimed that the Fletcher automatic liquid scale will continuously and automatically weigh liquids of up to 150,000 SSU viscosity. Four sizes are available with capacities up to 150 tons per hour and details can be obtained from George Fletcher and Co Ltd, Masson Works, Derby.

Hamer Valves

Hamer Valves, Inc., Long Beach, California, and Joshua Hindle and Sons, Ltd, of Leeds, England (licensed manufacturers of Hamer valves) jointly announce the appointment of Société d'Études Pétrolières, as exclusive selling agent for Hamer products in France and French possessions. Société d'Etudes Pétrolières will also assist with representation and sale of Hamer products in Spain, Italy, Holland, Switzerland, Belgium, Luxemburg, Western Germany, Yugoslavia, Norway, and Sweden.

Power Arm Rotary Drill

A new type of power arm rotary drill is now being manufactured by Hands England Oilfield Equipment Ltd and an illustrated booklet giving details of the equipment is available from the Company's offices at Letchworth, Hertfordshire.

Gamma Ray Projector

A 24-page booklet recently issued by The M. W. Kellogg Company gives details of a new portable gamma ray projector which has been designed for use in industrial radiography.

The new projector offers decided advantages of economy and operation over conventional X-ray equipment. Prototypes have been used for some time by Kellogg to check welds before a processing unit is put into operation.

New Heated Hose

A new type of heated, flexible hose has been devised by Heron Heating Devices of Blenheim Street, Newcastle upon Tyne, for the conveyance of liquids and gases at constant temperatures up to 200°F. The hose is constructed from steel and copper braiding, through which electric current is passed, combined with synthetic rubber and a special heat-resisting material.

The hose is at present manufactured in 60-foot lengths with a bore of $\frac{3}{8}$ inch.

Iranian Oil Figures

Production of crude oil in South Iran by Iraanse Aardolie Exploratie en Productie Maatschappij N.V. during September amounted to 1,495,000 tons, bringing the total for the period 1 January to 30 September to 11,266,000 tons.

Refinery throughput at Abadan by Iraanse Aardolie Raffinage Maatschappij N.V. in September was 587,000 tons, giving a total of 5,568,000 tons from 1 January to 30 September.

Fuel oil for local consumption in Iran is now being drawn direct from a unit in the oilfields instead of from Abadan.

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CRUDE OIL PRODUCTION

	1955	
	Sept.	*Jan.-Sept.*
	Brl	
Kern Oil Co Ltd:		
California	98,758	
Trinidad	81,927	
Trinidad Petroleum Development Co Ltd.	312,811	
	Tons	
Iraq Petroleum Co Ltd	2,027,566	17,966,262
Basrah Petroleum Co Ltd	698,079	5,278,946
Mosul Petroleum Co Ltd	107,950	961,367
Kuwait Oil Co Ltd	4,121,129	40,439,915
Qatar Petroleum Co Ltd	451,152	3,963,619

[*Continued from previous page*

than expand owing to the development of improved pharmaceutical alternatives. The current off-take of white oils for cosmetics is also steady but probably not a continually expanding market. This market would probably vanish in the event of war. The total production of white oils will be largely governed by these two markets and the overall assessment indicates a possible decrease rather than an increase.

Unfortunately, the bulk of sulphonate production in the U.K. is tied to white oil manufacture. There is an expanding market for sulphonates and its growth will coincide with the growth of the lubricating oils market rather than as a result of new applications or substantial increases in the amounts of additive per gallon of oil.

We are, therefore, faced in the U.K. with a possible recession or limitation of white oil production coinciding with an increased demand for sulphonates, the ceiling of which will be governed by lubricating oil consumption. It is, therefore, apparent that new methods of sulphonate recovery must be applied to produce the maximum yield of sulphonates in white oil processes. Alternatively imports must be made from Continental or American sources or there must be recourse to synthetic materials.

Steps are being taken to augment production of sulphonates in existing processes, but whether these steps will be adequate to meet the final demand is not easy to guess. They certainly would not be adequate in a national emergency. Synthesis would automatically raise the price of the material and the economic standpoint, with reference to alternative dollar expenditure, would have to be considered very carefully.

Acknowledgement

The section of the paper on liquid paraffin manufacture was based on a contribution by V. Biske and A. Cluer of Lobitos Oilfields Ltd. to the Fourth World Petroleum Congress. The work resulting in Figures 4 and 5 was carried out by B. S. Wilson, also of Lobitos Oilfields Ltd.

U.S. Petroleum Refineries

The decline in the number of United States petroleum refineries, which has been apparent for a number of years, continued during 1954, with a compensating increase in throughput capacity. The number of refineries declined by 11 and the increase in capacity for the year was 413,733 b.d. On 1 January 1955, there were 326 refineries in the U.S.A. with a total crude oil throughput capacity of 8,420,630 b.d. and an actual operating capacity of 7,379,000 b.d. or 87.6 per cent of installed capacity. Additional crude oil capacity under construction totalled 146,800 b.d.

In the *report covering this subject, details are given of the location, ownership, and capacity of individual refineries and cracking plants, together with summaries of refineries and cracking plants by years, districts, and States.

Data relating to U.S. refineries in the past five years are extracted in Table I.

TABLE I
U.S. PETROLEUM REFINERIES

	Number		*Crude Oil Capacity, b.d.*			
1 *Jan.*	*Optg.*	*Total*	*Optg.*	*Shut-dn.*	*Total*	*Building*
1951	325	357	6,701,815	261,829	6,963,644	160,100
1952	327	350	7,161,366	171,519	7,332,885	282,680
1953	315	343	7,481,701	156,960	7,638,661	509,721
1954	308	337	7,782,103	224,794	8,006,897	397,500
1955	296	326	8,069,154	351,476	8,420,630	146,800

Breaking down the increase in crude oil capacity by refining districts, 32 per cent was installed at refineries in the Texas Gulf Coast district, 25 per cent in the East Coast district, and 13 per cent in both the Louisiana Gulf Coast and the California districts. The Appalachian No.1, Texas Inland, and New Mexico refining districts reported declines in capacity during the year.

The largest refineries in terms of crude oil operating capacity were:

	B.d.
Humble Oil and Refining Co, Baytown	282,000
Esso Standard Oil Co, Baton Rouge	265,600
Gulf Oil Corporation, Port Arthur	245,000
The Texas Company, Port Arthur	210,000
Standard Oil Co (Ind.), Whiting	195,000

The five largest refining companies, on a similar basis, were:

	B.d
The Texas Co	577,000
Esso Standard Oil Co	571,000
Shell Oil Co	504,000
Gulf Oil Corporation	440,654
Sinclair Refining Co	425,000

Cracking Capacity

During 1955 cracking facilities to produce cracked gasoline increased by 12·7 per cent to 2,535,434 b.d. on 1 January 1955. At that date new cracking facilities totalling 234,370 b.d were under construction and an additional 31,200 b.d. was being built to replace existing equipment. The operating percentage was 94·9 per cent compared with 97·4 per cent the previous year. A summary by types for the last five years is given in Table II.

*"Petroleum Refineries, including Cracking Plants, in the United States, January 1, 1955". J. G. Kirby, *U.S. Bur. Mines Inf. Circ.* 7724.

TABLE II
U.S. CRACKING PLANT CAPACITIES IN BRL/DAY

	Types of Plant			
1 *Jan.*	*Reformed*	*Thermal**	*Catalytic*	*Total*
1951	295,500	776,796	780,810	1,853,106
1952	333,703	774,696	907,544	2,015,943
1953	355,297	789,558	1,005,602	2,150,457
1954	414,358	727,183	1,107,923	2,249,464
1955	588,968	627,888	1,318,578	2,535,434

*Includes some reformed and catalytic

Based on the criteria of total operating capacity for cracked gasoline, irrespective of type of operation, the largest plants were:

	B.d.
Pan American Refining Corp, Texas City	73,000
Gulf Oil Corp, Port Arthur	66,950
Shell Oil Co, Roxana (Wood River)	62,200
Standard Oil Co (Ind.), Whiting	57,500
Esso Standard Oil Co, Baton Rouge	56,300

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OIL COMPANIES' ORDERS IN THE UNITED KINGDOM

The Oil Companies Materials Secretariat has issued the following statement of the value of orders for materials and equipment placed in the United Kingdom by oil companies during the period April to June 1955:—

	£
Geophysical and other exploratory equipment, etc.	3,528
Specialized equipment for oil drilling and production, including oil casing, tubing, etc.	3,172,464
Specialized equipment for oil refineries, etc. (not including pumps and valves)	1,823,337
Drum and can-making, filling and cleaning equipment, kerbside pumps, and other oil metering and dispensing equipment, etc.	337,091
Railcars, road tankers, aircraft refuellers, etc.	74,968
Drums, drumsheets and tinplate	2,546,916
Tankage (including tank fittings)	1,554,924
Tubulars, pipe fittings, and valves (ferrous and non-ferrous)	4,589,499
Pumps, (excluding slush, oilwell, and kerbside)	606,020
Boilers, boiler house plant and accessories, etc.	52,930
Electrical equipment—motors, generators, transformers, etc.	1,612,112
Instruments, meters and gauges, etc.	539,945
Prime movers and compressors	639,885
Machine and hand tools, welding and miscellaneous machinery and stores	2,254,183
Ferrous and non-ferrous plates, sections, sheets and bars	1,127,618
Automotive equipment, all types	1,468,353
Laboratory equipment and chemicals, including hospital and medical supplies	214,030
Bulk chemicals, catalysts, barytes, etc.	5,054,718
Cement and other building materials and hardware, including timber	1,094,555
Commissary, general requisites for office, warehouse, household, club, and sports, etc.	1,619,051
	£30,386,127

The BP Cornwall Aircraft Fueller

A BP photo

Fig. 2. The BP Cornwall fueller

To meet the higher fuelling speeds required by the latest types of aircraft coming into operation, the BP Aviation Service of the British Petroleum Company have recently introduced a new mobile fueller known as the "Cornwall".

Representing the latest approach to the problem of fuelling civil aircraft with mobile equipment, this vehicle was designed by the Company's engineers. It has been developed and built by Thompson Brothers of Bilston, Staffordshire, on both Leyland and Foden chassis.

The "Cornwall" has a usable bulk capacity of 3400 Imperial gallons and is arranged for operation with a trailer which will augment the capacity to a total of 5900 Imperial gallons. It can deliver either gasoline or kerosine fuels and is primarily intended for use overseas. Three are already in use in Switzerland, Denmark, and France and further units are being built for use in Europe, Scandinavia, and Australasia.

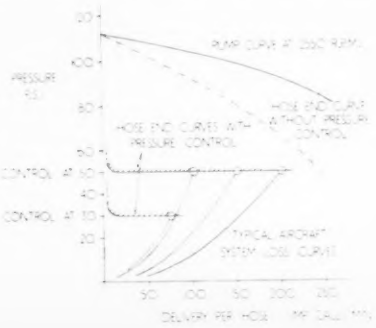
PRESSURE
PUMP CURVE AT 2500 R.P.M.
HOSE END CURVE WITHOUT PRESSURE CONTROL
HOSE END CURVES WITH PRESSURE CONTROL
CONTROL AT 50
CONTROL AT 10
TYPICAL AIRCRAFT SYSTEM LOSS CURVE
DELIVERY PER HOSE

Fig. 1. Performance envelope. Double line delivery. 2½-inch hoses, 1⅜-inch venturi. Delivering turbine fuel.

The dispensing equipment is of the latest type with a nominal pumping capacity of 400 Imperial gallons per minute and a maximum pumping capacity of 500 gallons per minute, with into aircraft pressures of 50lb per square inch. This gives the unit a remarkably large performance envelope, as is illustrated by the performance graph (Fig. 1), and is capable of meeting the requirements of all known and projected civil aircraft.

To achieve such a high pumping performance whilst maintaining a large bulk capacity has necessitated a complete re-design of the conventional aircraft fueller delivery circuit and the system now employed is the BP low-loss circuit with an auxilliary defuelling facility (for which a patent has been applied for) fitted optionally according to the requirements of the particular area where the vehicle will be operating.

The adoption of the low-loss circuit enables the vehicle to operate at its nominal capacity with a total circuit loss from pump to hose end of only 30lb per square inch.

A general view of the fueller built on the Leyland 19H-7AE chassis is shown in Fig. 2, whilst Fig. 3 shows the operating controls, which are symmetrically laid out for ease of operation. Fig. 4 shows the maintenance side of the fueller where the Rellumit fine-particle filters are in a very accessible position. This view also shows the position of the pressure control valve, by which, during underwing fuelling, the pressure in the gallery pipes in the aircraft is closely controlled within the allowable limits specified by the aircraft manufacturer.

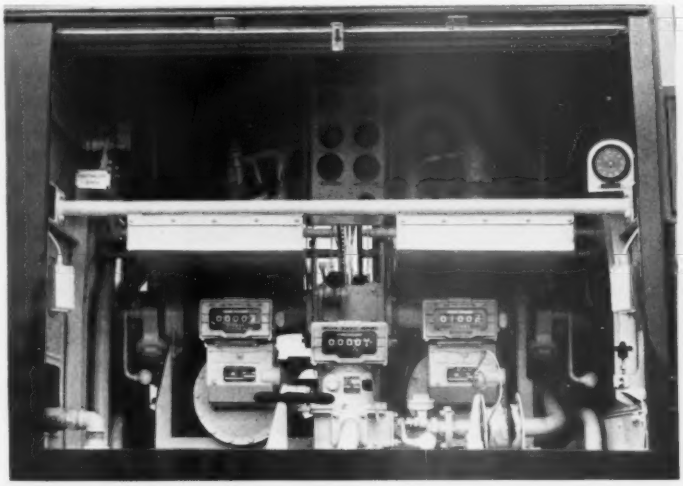

Fig. 3. Operating controls of the re-fueller

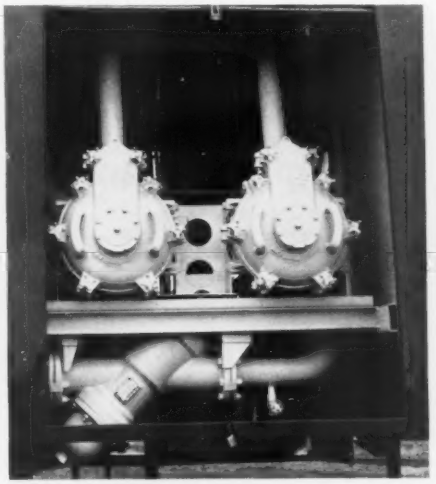

Fig. 4. The Rellumit filter

Fig. 5. Flow diagram of B.P. Cornwall fueller.

The line diagram of the circuit employed is shown in Fig. 5, which clearly illustrates the "straight through" nature of the low-loss circuit. Fuel from the two-compartment tank passes via the foot valves into the gallery line and straight into the pump. Delivery from the pump is taken via the pressure control valve, which is of the throttling type, to the fine particle filters and thence to the meters and hose reels.

The defuelling operation is effected by applying suction to either hose reel via 1½-inch Avery Hardoll self-sealing couplings, and delivery back to tank is through the defuelling meter installed for this purpose.

In addition to the requirement for a maximum pump performance, very careful attention has also been paid to ease of maintenance of the equipment and this has largely been assisted by the adoption of a shaft drive for the single-stage Pegson pump. The pump is mounted above the propeller shaft and is direct-driven by a Layrub shaft from the power take-off on top of the main gear box. The pump incorporates a step-up gear of 2·43 : 1 ratio to allow for operation over the required speed range with suitable engine revolutions. As a result of this arrangement good accessibility is achieved to all the working components in the pump compartment from the near side of the vehicle.

For pressure fuelling at maximum speeds the Cornwall operates with 2½-inch-bore hoses but for overwing fuelling, and pressure fuelling within the range of 100-130 Imperial gallons per minute, 2-inch hoses, 100-feet long, are used, which enable four-engined aircraft with wing-tip tanks to be filled from one central position in front of the nose of the aircraft.

The dispensing of aviation fuels calls for the most stringent precaution against ingress of any foreign matter into the fuel. In addition to the provision of fine particle filtration, the tank of the Cornwall is treated with Prodorfilm, a synthetic resin lining made by Prodorite Ltd, and the pump and all pipework are hot-tinned.

To assist in maintaining maximum utilization of equipment the Cornwall is provided with arrangements for bottom loading on either side of the vehicle, using the Avery Hardoll 2½-inch self-sealing coupling.

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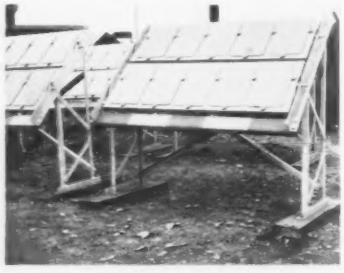
Painting of Structural Steelwork

A report of considerable importance to engineers concerned with the maintenance and long life of steel structures, has just been issued by BISRA (The British Iron and Steel Research Association). Its title is "The Painting of Structural Steelwork" and its 40 pages, which constitute the third interim report of the Joint Technical Panel J P1, give results of four long-term investigations which were started between 1945 and 1948. These investigations were concerned with the protective painting of steel, the first two relating to priming paints, the third to painting over metallic coatings and methods of surface preparation before painting, and the fourth to protective paints based on tars or bitumens.



Panels under exposure to the atmosphere in the BISRA corrosion tests.

Hundreds of test specimens were prepared and exposed at two sites. One was at Brixham in a mild seaside atmosphere and the other at Derby in a severely corrosive industrial atmosphere.

The first series of tests indicated that a mixed red lead, white lead, and asbestine in linseed oil paint was suitable for all-round use on steelwork. Such a paint has been included in BS 2523 : 1954 for lead-based priming paints.

For the second series, metallic pigments, mainly with aluminium and zinc, were examined. No generalization as to the relative merits of these pigments could be made, but it was noted that while zinc-rich paints did not give particularly good results, priming paints based on mixtures of metallic aluminium powder with basic lead sulphate or zinc oxide and in an alkyl medium performed excellently. Paints of this type seem worth consideration for industrial development.

The third series related to nine varieties of metallic coating, none of which had failed by rusting to any significant extent after six years' exposure.

Tar and Bitumen Paints

The paints studied in this series fell into five categories: (i) solutions of fluxed pitches; (ii) solutions of bitumens; (iii) blends of natural bitumen with drying oils; (iv) pigmented bitumen solutions; (v) pigmented paints based on a natural bitumen and drying oils.

The natural bitumens were Gilsonite and Raphaelite, while the petroleum bitumens were as follows.

Hard residual, 5-15 pen;
Medium residual, 15-25 pen;
Medium-soft residual 30-40 pen, 60°C softening point;
Hard blown, 16 pen, 117°C softening point;
Medium-hard blown, 30 pen, 73°C softening point.

Briefly, the conclusions drawn for each category show that : (i) the fluxed coal tar pitches gave poor protection to steel; (ii) none of the straight bitumen solutions gave good results directly over steel; (iii) unpigmented blends of natural bitumen and drying oils were not suitable at Brixham but some good performance was obtained at Derby; (iv) the addition of pigments improved the performance of bitumen solutions but these paints were markedly inferior to those in category (v) in which all paints based on pigmented natural bitumen and drying oils performed well, none of 16 specimens having reached 0·5 per cent of rusting after six years.

The report, which gives full results, tables, charts, and illustrations, is obtainable from BISRA, 11 Park Lane, London, W.1., price 5*s*. post free.

Notes of the Month

Bravery Award

R. Laurie, Shell operations manager in Uruguay, has been awarded the O.B.E. for brave and determined action in preventing a serious fire last June.

The incident occurred when a Uruguayan pumpman, having apparently lost his reason, climbed a 1000-ton tank, started a fire with a box of matches, and set light to himself.

Mr Laurie (right) *receiving his award from Mr Platt.*

A Shell photo

At great personal risk, Mr Laurie climbed the tank, extinguished the flames engulfing the man, and directed fire-fighting equipment onto the tank so that it was saved. The pumpman unfortunately died from his injuries.

Mr Laurie has been with Shell since 1938 and has held a number of senior appointments in foreign countries. At a ceremony in London recently he was presented with a gold watch and a cheque by J. W. Platt, a managing director of Shell.

ASME Honours

Included in a list of eminent persons who have recently been awarded honorary membership of The American Society of Mechanical Engineers are J. H. Doolittle, Vice-President and member of the executive committee, Shell Oil Company, New York, and C. G. A. Rosen, consulting engineer, Caterpillar Tractor Company, Peoria.

Vacuum's New Motor Oil

Introduced to the British market on 16 October, Vacuum Oil Company's new motor oil "Mobiloil Special" is a multi-viscosity oil covering the SAE 10W-30 range. It is stated to be an all-season all-weather oil manufactured to meet the demands of the new higher compression ratio engines and also to improve the performance and prolong the life of older cars. Prior to its introduction in Britain, extensive laboratory and road tests were carried out. The latter involved nearly 300 cars covering over two million miles in the U.S.A., in the U.K., in North Africa, and on the Continent.

A Product Engineering Manual describing the new oil is available from Vacuum Oil Company Ltd.

Esso Laboratories Extensions

Extensions costing about one million pounds are to be undertaken at the Esso European Laboratories near Abingdon. They will be completed towards the end of 1957.

New engine testing, analytical, inspection, and research laboratory facilities are to be built as well as new office buildings.

Announcing these plans recently, C. S. Windebank, managing director of the Esso Development Co Ltd, spoke of the vital role of research in the oil industry. Highly competitive conditions in the industry meant that companies must constantly strive to produce better products at lower cost and to achieve this, intensive research was necessary.

The Esso Research Companies were spending well over ten million pounds a year finding out what the customer wanted and how to meet these needs at the lowest cost.

Abandonment of Gippsland Well

Darriman No. 1 well which was being drilled in Gippsland, Australia, by Frome Lakes Pty Ltd., has now been abandoned and plugged at a depth of 4730 feet.

No indication of oil or gas had been found at that depth. Future developments in the area will be guided by the results of an examination of data obtained from the drilling of Darriman No. 1.

Refinery for Havana

Havana, Cuba, is to be the site of a new oil refinery which is to be built for operation by a Cuban Company jointly owned by Shell and the Canadian Eagle Oil Co. Ltd. The new plant will have an intake of about $1\frac{1}{4}$ million tons of oil a year and is expected to come on stream before November 1956.

The 130-acre site for the new refinery has already been prepared and work has begun on the erection of the major units.

Building of the new refinery is being financed by Shell and the Canadian Eagle Oil Co. Ltd. and completion of the

A Shell photo

The "English Electric" Canberra P.R.7, which recently set up a new two-way trans-atlantic flight record, photographed as it took on fael supplies at London Airport.

project will bring their total investment in Cuba to over $19,000,000.

The Cuban Company which is to own and operate the new refinery is at present a marketing Company which also has a growing interest in chemical and agricultural products.

Vacuum 20-Year Club

Members of the Vacuum Oil Co Ltd who have completed 20 years' service with the Company gathered at celebration dinners held throughout the world on 21 October.

These informal dinners are annual events providing an opportunity for long-service employees to come together and for those who have retired to keep in touch with former colleagues.

The London dinner was held in the Connaught Rooms and was attended by Club members from Coryton and Wandsworth as well as from the London headquarters and sales offices; Mr Miles Reid, a director of the Company, attended the dinner as guest of honour.

BSI Petroleum Standards

In its Report for the year ended March 1955 the British Standards Institution makes reference to discussions between the BSI and the IP which have resulted in a procedure being evolved whereby IP Standard Methods can be submitted to the BSI for incorporation in national standards. This is a valuable step, as methods being considered internationally by ISO should have a national standard basis.

A Shell photo

Special prefabrication methods had to be employed by Whessoe Ltd in the construction of four giant catalyst hoppers 30 ft in diameter and 87 ft high for shipment to Shell's refineries at Cardon, Venezuela, and Curaçao. The hoppers were sub-assembled to consist of only five sections, thus ensuring ease of loading, shipment, and final assembly. Photo shows part of a hopper being loaded aboard a cargo ship at Middlesbrough.

During the year a revision of BS 489, steam turbine oils, was published and at the end of the year work was in hand on a number of new and revised methods.

In the field of petroleum equipment, two standards on valves were issued in revised form, and new standards on kerosine lighting appliances and on butane cooking appliances were issued. Work was in hand at the end of the year on a variety of matters from aircraft fuelling hose to storage tanks.

New Tanker for Royal Navy

A new 26,000-ton tanker, the R.F.A. *Tidereach*, has recently come into Royal Naval service. Built by Swan Hunter and Wigham Richardson Ltd. at Wallsend-on-Tyne, the new tanker, like her sister ships *Tiderace* and *Tiderange*, is intended for the support of the Fleet and the replenishment of its supplies under way at sea.

R.F.A. *Tidereach* is capable of carrying a fuel cargo of 15,000 tons and is fitted with up-to-date handling gear for transferring food, stores, ammunition, oil, and jet aircraft fuels to ships needing them. Her oil cargo can be subdivided into five different categories and all can be discharged at extremely high rates to ships on either beam or astern and while steaming at high rates.

R.F.A. *Tidereach* has a maximum speed of over 18 knots. She is approximately 580 ft long, 70 ft in beam, and has a loaded displacement of approximately 32 ft.

Third Voith-Schneider Tanker

B.P. Miller, third of nine estuarial tankers under construction for Shell-Mex and BP Ltd, was launched recently from the Wallsend-on-Tyne yard of Clelands (Successors) Ltd.

Conforming to the pattern for these nine new tankers, *B.P. Miller* is fitted with a Voith-Schneider propeller giving great manoeuvrability in narrow waterways.

B.P. Miller has an overall length of 139 ft, a moulded breadth of 12 ft 6 in, moulded depth of 12 ft, and a deadweight carrying capacity of 460 tons.

BP Tanker Orders

Orders for 23 new tankers totalling 836,000 dwt have been placed by the British Tanker Company, The British Petroleum Company's shipping subsidiary. Seventeen of the new vessels are to be built in British shipyards and six in Italy and delivery will take place in 1958 and 1959. All the vessels will be super-tankers and at present building prices the cost totals about £52 million.

More Tanker Orders

A £12,000,000 order for a further seven tankers to join the Eagle fleet has been placed with the U.K. shipyards of Cammell Laird and Co, the Furness Shipbuilding Co Ltd, and Smith's Dock Co Ltd. Delivery is expected between 1957 and 1959.

Three of the ships will be of 18,000 dwt and four will be super-tankers of 32,000 dwt.

The Eagle fleet is operated by the Eagle Oil and Shipping Co Ltd and a total of 13 tankers are now scheduled for delivery to the fleet between 1955 and 1959. Allowing for obsolescence, the Eagle fleet will exceed 500,000 dwt by the close of 1959.

Further orders for tankers have also been placed recently by Shell. Eight new vessels, two of 32,000 dwt and six of 18,000 dwt, are to be built at three German yards and a ninth, a 32,000 dwt vessel, is to be built in the U.K.

Deliveries are expected to take place between 1958 and 1960.

Shell's present programme now comprises 43 tankers with a total of 1,000,000 dwt. Of these, 21 are to be built in the U.K., 14 in the Netherlands, and 8 in Germany.

Kirkuk Produces 150 Millionth Ton

One hundred and fifty million tons of crude oil have now been produced at the Kirkuk Field of the Iraq Petroleum Co Ltd. Only four other fields in the world have achieved this cumulative total.

There are now 43 flowing wells in the Kirkuk Field producing a total of some 24 million tons of oil each year.

BSI Elections

Sir Herbert Manzoni, C.B.E., Engineer and Surveyor of the City of Birmingham, has been elected Chairman of the General Council of the British Standards Institution. This was announced at the Annual General Meeting of the BSI held recently in London.

Sir Herbert has played a leading part in the development and application of standardization techniques in the building and civil engineering industries.

It was also announced at the Annual General Meeting that Sir Roger Duncalfe, Chairman of British Glues and Chemicals Ltd, has been re-elected as President of the Institution and that Mr John Ryan, Vice-Chairman of the Metal Box Co Ltd, has been elected as Vice-President on completion of his three-year period as Chairman of the General Council.

Shell Laboratory to have "Atom Smasher"

A three-million-volt, Van de Graaff, particle accelerator is to be installed at the Emeryville, California, research laboratory of the Shell Development Company, U.S.A. It will be the first of its size to be used in the petroleum industry and the second to be put into operation by Shell.

Installation of this new unit will take place in June 1956 and it will then be used in studying the effects of radiation on fuels, lubricants, plastics, and other oil-derived products. The machine produces a radiation field of extreme intensity, several hundred times more powerful than the best radio-active cobalt sources now used in industry.

The radiation which is produced by the new unit is in the form of a high intensity beam of electrons which is used to bombard products and so cause changes in their physical characteristics. From this, scientists will learn more about the changes that take place in matter exposed to high energy radiation.

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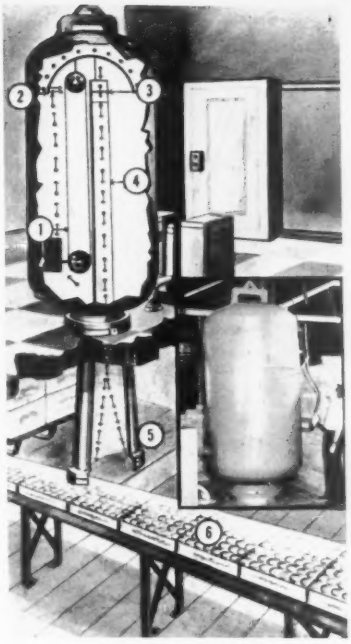
A Shell photo

Two Westland Whirlwind helicopters pictured before they set off on the longest flight ever made by British machines. They were destined for Doha, capital of the Persian Gulf sheikhdom of Qatar, where they will be used to fly staff and supplies between Doha and Shell's off-shore drilling locations. Doha is 3400 miles from the departure point at Eastleigh Airport near Southampton where this picture was taken.



Installation of the Van de Graaff particle accelerator, with diagrammatic representation of its operation.

A Shell photo

The accompanying illustration shows how the atom smasher will be installed. The inset photo shows the housing for the voltage-generating column which produces the electron beam; this will be situated on the upper floor and material being exposed to radiation will be passed through the beam on the floor below.

The diagram explains its operation. An electric charge sprayed on a fast-moving belt (1) is carried to the top of the column and transferred to a terminal (2), resulting in a great voltage difference between the upper and lower ends of the machine. Charged particles leave the terminal through a heated cathode (3) and pass downward along the high vacuum tube (4) where they are accelerated to almost the speed of light. A funnel-like attachment (5) directs the particles precisely on to material being irradiated, which is passed through the beam on a conveyor belt (6).

The accelerator has further advantages over other radio-active sources for industrial use in than it presents no radiation hazard when turned off and is easily adapted to continuous production techniques such as conveyor belt treatment systems.

Shell's first accelerator, a two-million-volt machine, was installed at the Houston laboratory in the autumn of 1954. It has been used for "ageing" rocks atomically by bombardment with protons to help scientists in assessing the age of rock formations in their search for oil.

Petrochemicals Ltd.—New Directors

The Board of Directors of Petrochemicals Ltd., now a subsidiary of Shell Chemical Co. Ltd., has been reconstituted as follows: chairman, W. F. Mitchell, F.Inst.Pet.; managing director, L. H. Williams, A.M.Inst.Pet; general manager, F. H. Braybrook, F.Inst.Pet; and directors, F. Mackley, F.Inst.Pet; E. J. Barnsley, and L. R. Battern, A.F.Inst.Pet.

New Low-freezing Aviation Fuel

Recent investigations at Shell's Thornton Research Centre have led to the production of a new aviation turbine fuel which will not freeze at temperatures above —50 C.

This is an improvement on the Ministry of Supply's specification requirement of a —40 C freezing point. The new fuel will allow for the low temperatures which occur in

long range cruising at high altitudes and special tank insulation or fuel heating arrangements, which involve extra weight, will no longer be required.

New Mobile Dragline Cranes for Borneo

A Shell photo

The two lorry-mounted excavator cranes shown here were supplied recently by Ruston Bucyrus Ltd of Lincoln for use by the British Malayan Petroleum Co Ltd, a Shell associate, in Seria.

The cranes are highly mobile and can be used for very heavy work such as the handling of stone, sand, etc., and for dragline operations.

The crane superstructure is fitted to a Scammell Constructor 6 by 6 chassis.

Bakelite Ltd. to Market Polyethylene

Polyethylene plastics produced in the U.K. by Union Carbide Ltd. are to be marketed by Bakelite Ltd. as the result of a recently-concluded agreement.

A plant is at present under construction at Grangemouth where Union Carbide Ltd. will produce polyethylene of the same quality and types as that now made in the United States.

BP Vacation Training Scheme

Over 100 undergraduates from U.K. and overseas universities took part in B.P.'s summer vacation training scheme this year. For two months the undergraduates were able to do practical work at the Company's three major refineries, at the Eakring oilfield, and at the research stations at Sunbury and Kirklington Hall.

Practical instruction was given by B.P. technicians, while the theory was explained by three university lecturers who accompanied the students.

New Plant for Peruvian Oilfields

Sea-water evaporating and distilling plants have been ordered for installation at the Lobitos Oilfield in Peru. They are to be supplied by G. and J. Weir Ltd of Cathcart, Glasgow, and will supply all the fresh water requirements of the oilfield, including water for domestic use.

Production of "Ketjencat"

In 1953 the Koninklijke Zwavelzuurfabrieken v h Ketjen N.V. completed its plant for the production of its fluid catalyst for cracking known as "Ketjencat". Immediately steps were taken to enlarge the plant and today it is double its original capacity. The company also produces a fluid catalyst for hydroforming (Ketjenform). Both catalysts are manufactured under licence, the first from the American Cyanamid Co, and the latter from Esso Research and Engineering Co.

Head Wrightson Heat Exchangers

Head Wrightson Processes Ltd have signed an agreement with D.Bonaldi and Co. for the manufacture in Italy of the Head Wrightson air-cooled heat exchangers.

Conference on Lubrication and Wear

The Institution of Mechanical Engineers is arranging a Conference on Lubrication and Wear to be held in London 1–3 October 1957 inclusive. Provisional arrangements are:—

1 *October:*

11.30 to 12.30:

Opening by the President, welcome to visitors, and outlining of the arrangements.

2.15–4.45:

Summarizing and review papers on:

(i) The limitations of the theoretical treatment of fluid-film lubrication and the relationship with experimental results.

(ii) Evaluation of present knowledge in regard to fluctuating loads and bearing oscillations.

(iii) Thin film and elasto-hydrodynamic lubrication.

Individual papers on recent work will also be included.

6.0–8.0:

Papers on the physics and physical chemistry of solid friction and boundary lubrication, including individual papers on recent work.

2 *October*:

10.0–12.30 and 2.30–5.0:

Papers on wear, including fretting corrosion; running-in of mechanisms; wear through abrasive particles; wear through foreign particles; influence of rubbing materials; influence of lubricants; scuffing; major surface changes; influence of nature and finish of rubbing surfaces, and influence of superficial films; techniques of wear investigation.

3 *October*

10.0–11.15; 11.30–12.45; 2.15–3.30; 3.45–5.0:

A series of papers dealing with various aspects of lubrication, presented in three meetings running concurrently.

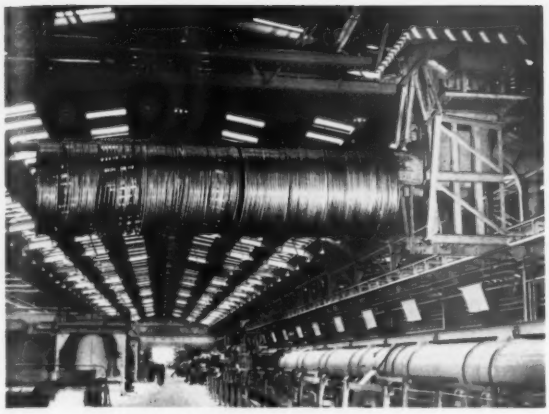
The first meeting will include papers dealing with bearing metals and novel bearing materials, lubrication of glands and seals, solid lubricants, and surface treatments.

During the second meeting, papers on ball and roller bearings will be presented and on very high-speed bearings. In addition, gear lubrication will be dealt with.

The third meeting will be devoted to the presentation of papers on additives and special lubricants, on lubrication in metal forming and cutting, on the supply of lubricants to mechanisms, and on special problems in connexion with atomic energy.

The general principles of the meeting are that there should be some papers that will collate and summarize well-established aspects of the subject and where possible, enlarge on them, and other papers will be devoted to particular topics that are rapidly developing. The subject of wear would be an appropriate specialized subject.

It is desired that the published Proceedings shall constitute a useful reference work, and members and non-members of the Institution may contribute papers to the Conference. Each contribution will be treated on its merits. Therefore, intending authors are invited to first submit a brief synopsis of, say, 200 words setting out the proposed title and contents of their contributions. This should be received by the Secretary of the Institution at the latest by 1 April 1956, but notification before this date of intention to submit a synopsis would be very helpful. It is likely that the final manuscript will be limited to a maximum length of 3000 words. Illustrations will be permitted. Further information may be obtained on request from the Secretary of the Institution of Mechanical Engineers, 1 Birdcage Walk, London, S.W.1.



The Kirkby Works of ICI Metals Division is the largest copper tube factory in the British Commonwealth. One of its features is the ability to draw copper tubes in lengths of approximately 150 feet, the copper tubes being picked up on drums up to 5 feet in diameter. This picture shows a finished coiled tube being transported by rigid mast crane for storage.

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CONFERENCE ON DOMESTIC HEATING

The Institute of Fuel, with a number of other bodies participating, including the Institute of Petroleum, is to hold a Conference on Domestic Heating in the U.K.—Present and Future, at Church House, Westminster, London, on 1 and 2 May, 1956.

Present indications are that the Conference will be divided into four sections, dealing respectively with: I—Fuels; II—Appliances, Their Design and Application; III—Design of Dwellings; IV—The Origin and Administration of Smoke Control Areas.

In the first section all types of fuels will be dealt with and there will be at least ten papers. A paper entitled "Oil fuels, with special reference to the grades suitable for domestic heating" will be presented by R. J. Bressey. In Section II, G. J. Gollin is to read a paper on the "Present position and future development of domestic heating appliances fired by oil", and there will be at least twelve papers in this section. In Section III at least five papers have been arranged and in Section IV authors have been announced for six papers.

Enrolment fee for non-members of the Institute of Fuel will be 10*s.* 6*d.* to members of participating bodies and one guinea to others. This fee will cover notices, programmes, and a set of abstracts of all the papers. An additional fee will be payable for the full text of papers and for a record of the proceedings. Registered members will have first call on available seats on producing their membership ticket and once they are accommodated the remaining seats will be available to the public without charge.

Enquiries should be addressed to the Institute of Fuel, 18 Devonshire Street, London, W.1.

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY 1956 ANALYTICAL CONGRESS

The XVth Congress of the International Union of Pure and Applied Chemistry is to be held under the patronage of the Analytical Section of the Union in Lisbon during 1956.

The Congress will be divided into ten sections dealing with: microchemical methods; biological methods; electrical methods; optical methods; radiochemical methods; organic complexes; statistical interpretation of results; adsorption and partition methods; general matters; standardization of methods and miscellaneous applications. Papers will be essentially new or novel contributions.

Forthcoming Meetings

THE INSTITUTE

(*At* 26 *Portland Place, London, W.*1, 5.30 *p.m.—tea* 5 *p.m.*)

Statistics as an Aid to Specification. G. W. Sears, M.A., A.F.Inst.Pet. **14 December**

Petroleum Fuels for Domestic Heating and Lighting. G. F. J. Murray, A.M.I.C.E., A.M.I.Mech.E., A.F.Inst.Pet., and D. F. Tomkins B.Sc., A.R.I.C., M.Inst.Pet. **10 January**

IP FAWLEY BRANCH

(*At Esso* (*Fawley*) *Recreation Club, Holbury*, 7.30 *p.m.*)

New Developments in Refining Processes. W. N. Hoyte, B.A., Cantab., M.I.Chem.E., M.Inst.Pet. **16 December**

Drilling and Production of Crude Oil. R. K. Dickie, B.A., B.I.A., F.Inst.Pet. **13 January**

IP LONDON BRANCH

(*At* 26 *Portland Place, London, W.*1, 6 *p.m.—tea* 5.30 *p.m.*)

Film Evening. (At Shell-Mex House) **16 December**

Dinner Debate. **17 January**

IP NORTHERN BRANCH

(*At Engineer's Club, Albert Square, Manchester*, 2, 6.30 *p.m.*)

Film Show and Hot Pot Supper. (At Warner's Theatre, 5.30 p.m.) **13 December**

Symposium on the Lubrication of Transport Fleets. Chairman, A. T. Wilford, B.Sc., F.R.I.C., M.I.Mech.E. **17 January**

IP SCOTTISH BRANCH

(*At N.B. Station Hotel, Edinburgh*, 7 *p.m.*)

Off Shore Drilling. B. F. Saurin. (At G.P.R. Hall, Grangemouth, 7.30 p.m.) **15 December**

Annual General Meeting. Talk by R. Keddie. (At 7.30 p.m.) **26 January**

IP SOUTH-EASTERN BRANCH

(*At King's Head Hotel, Rochester*, 7.30 *p.m.*)

Annual General Meeting.

Film Show—A.B.C. of Oil, Drilling for Oil, Making Tyres, Discovery of Oxygen **3 January**

IP SOUTH WALES BRANCH

(*At Training Centre, National Oil Refineries, Llandarcy*, 5.30 *p.m.*)

The Chemical Engineer—His Training and Education—His Future in Industry. Professor E. S. Sellors, M.Sc., M.A. **5 January**

IP STANLOW BRANCH

(*At Grosvenor Hotel, Chester*, 7.30 *p.m.*)

The Shell Hydrodesulphurization Process. (Joint meeting with Royal Institute of Chemistry.) **14 December**

Annual General Meeting (At 7.0 p.m.)

Presidential Address. **18 January**

ECONOMICS AND OPERATIONS GROUP

(*At* 26 *Portland Place, London, W.*1, 5.30 *p.m.—tea* 5 *p.m.*)

The Economics of Tankage. C. A. Walder. **3 January**

OTHER SOCIETIES

Control of Corrosion in the Heavy Chemical Industry. D. R. Himsworth and W. D. Clark. Joint meeting of The Institution of Chemical Engineers with the Corrosion and Chemical Engineering Groups of the Society of Chemical Industry. To be held in the Large Lecture Theatre, King's College, London, W.C.2, 6.30 p.m. **25 January**

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SITUATIONS VACANT

Safety Engineer required by British Petroleum Company Limited at the Kent Oil Refinery, Isle of Grain, Kent. Preference will be given to a man having a Science or Engineering Degree or at least H.N.C. Experience in oil or heavy chemical industry desirable, with knowledge of U.K. Factory Acts. Progressive salary. Pension scheme. Write stating age, qualifications and experience to Box I.R.348, c/o 191, Gresham House, E.C.2.

Shell-Mex and B.P. Limited have a vacancy in their Head Office Technical Department. Minimum qualifications: a degree in chemistry or physics, or equivalent. Applicants should have experience in research, analysis, or production of petroleum fuels. Duties would entail supervision of quality control, investigation of fuel problems, and the provision of technical advice. No candidate over 35 can be considered. Excellent pension scheme. Starting salary commensurate with qualifications and experience. Plenty of scope for the man of average personality and intelligence. Apply, giving full details of education, qualifications, age and experience to: Staff Manager, (Ref D/57), Shell-Mex and B.P. Limited, Shell-Mex House, Strand, London, W.C.2.

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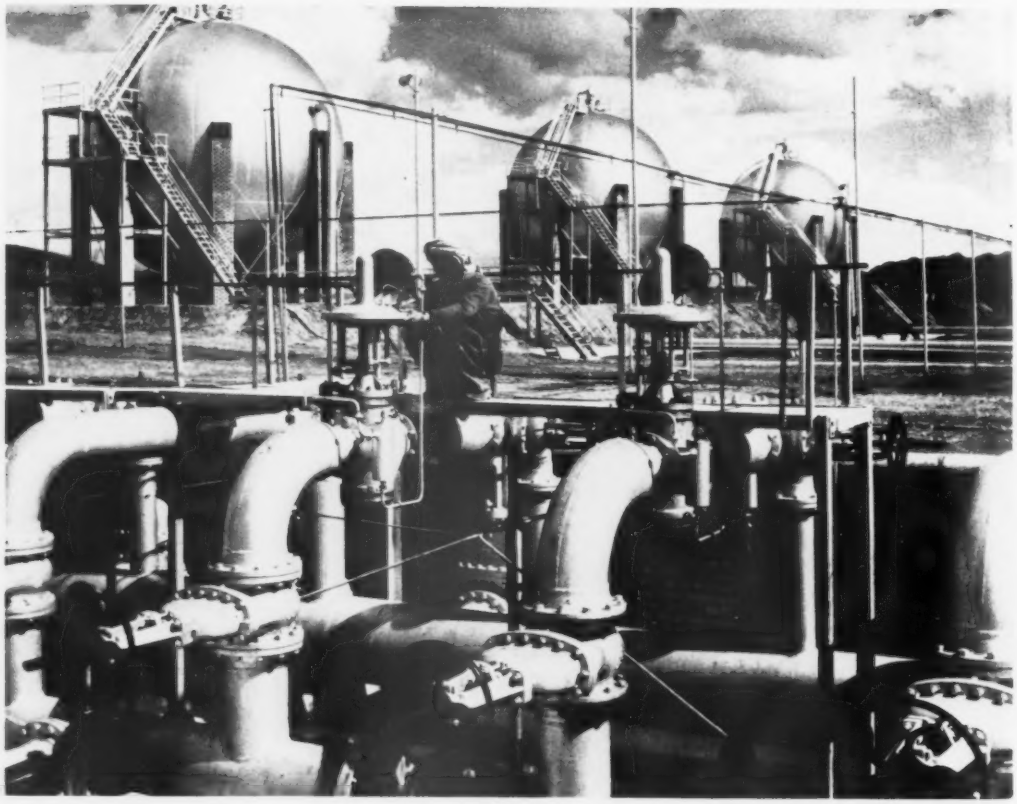

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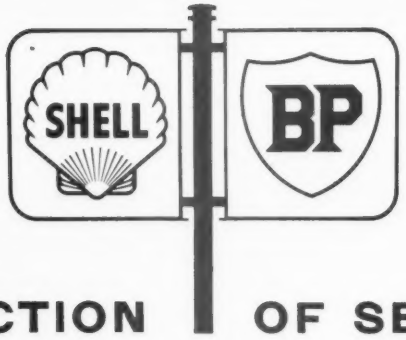

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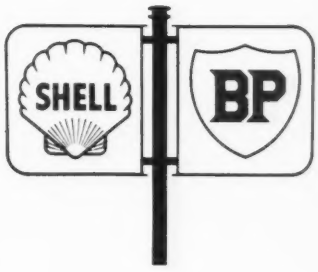

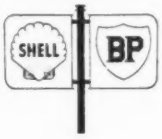

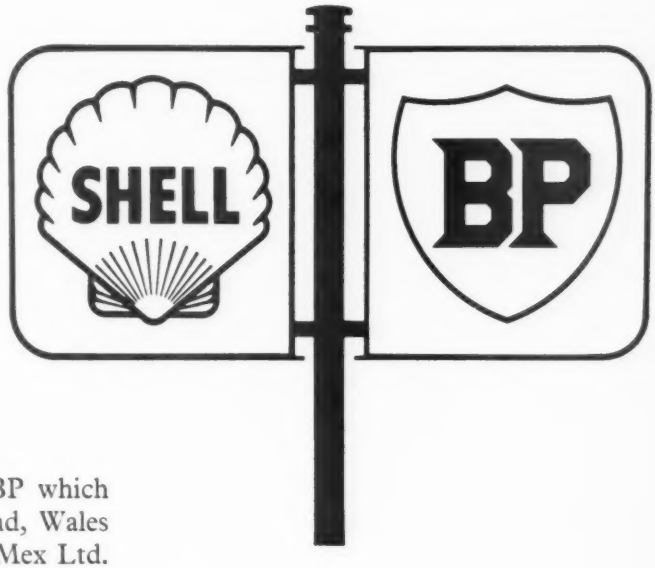

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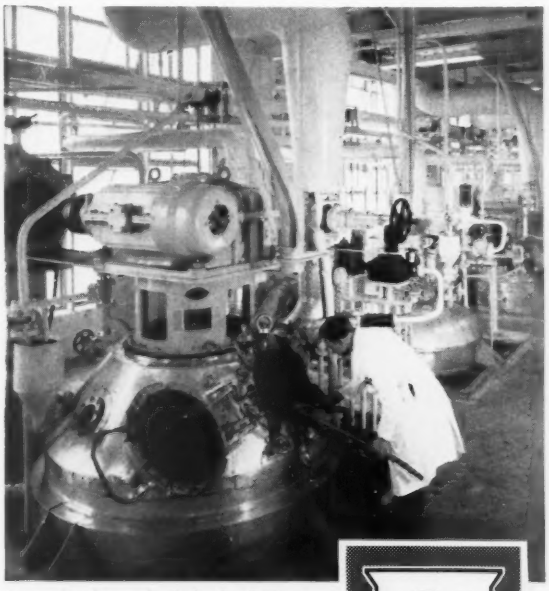

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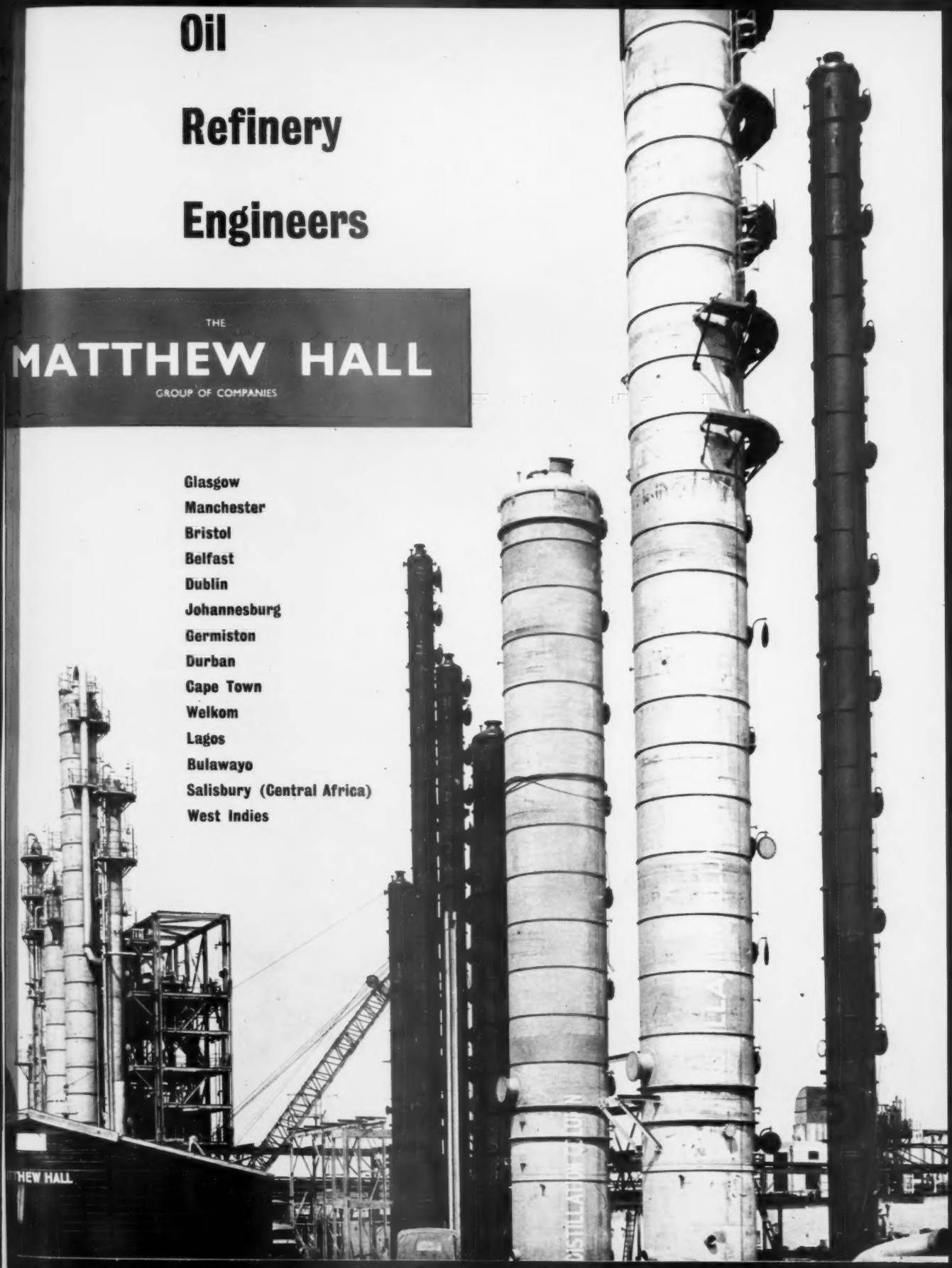

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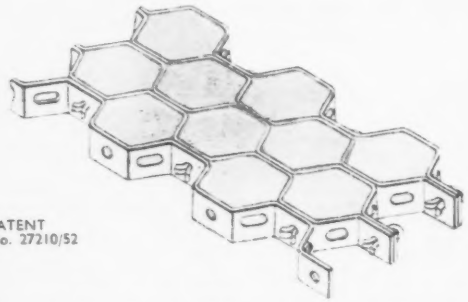

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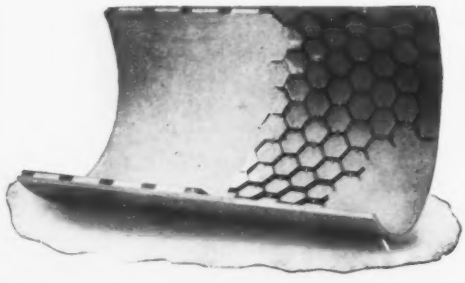

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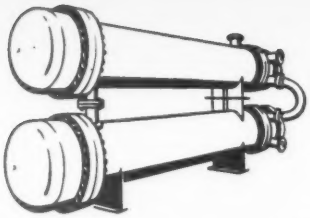

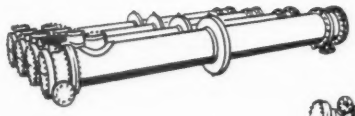

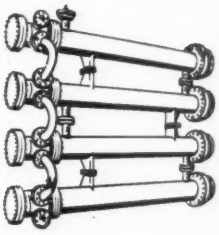

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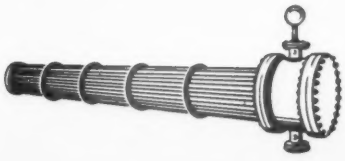

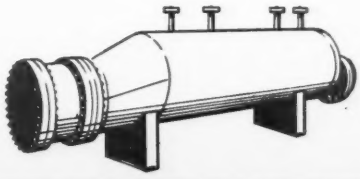

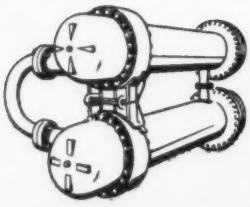

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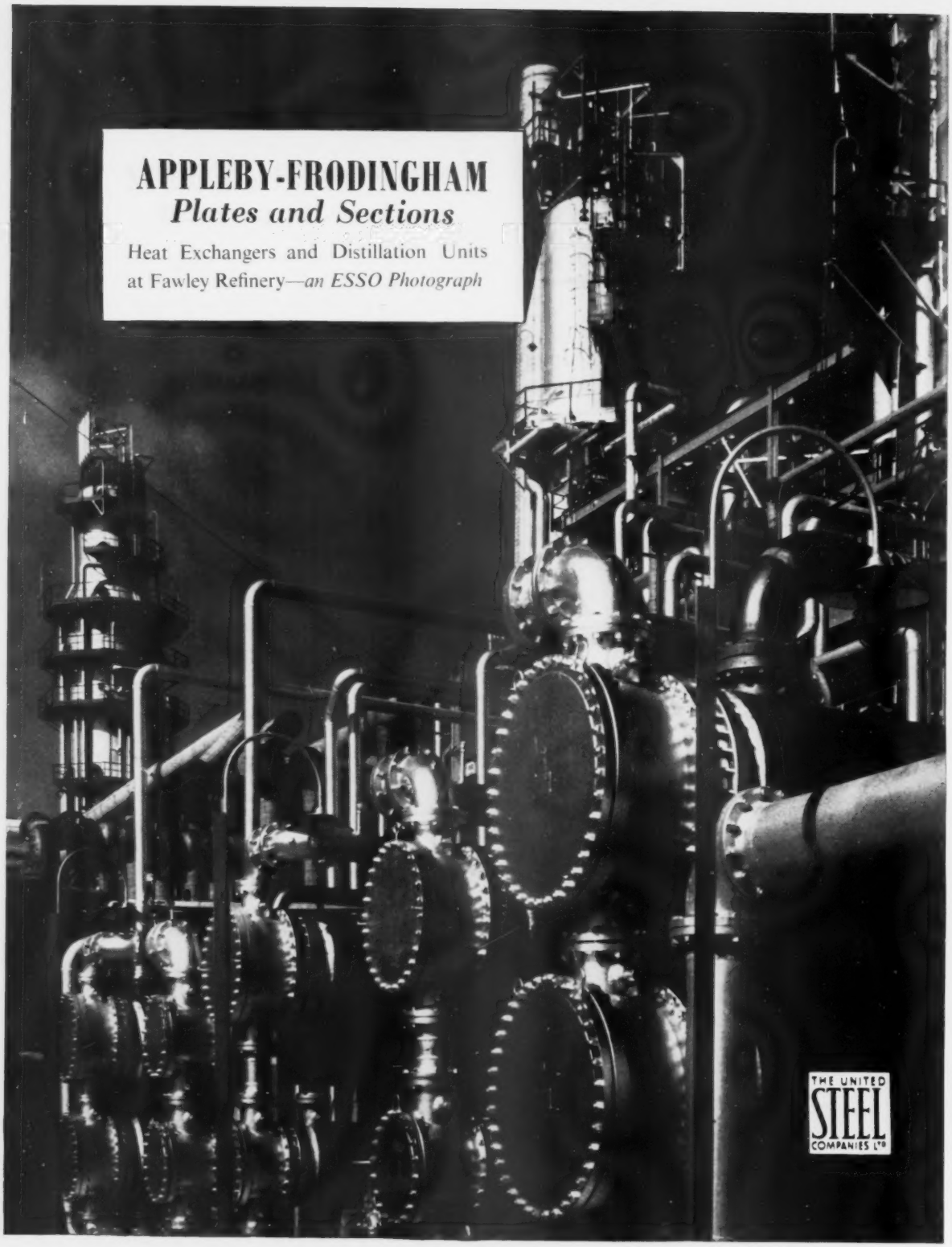

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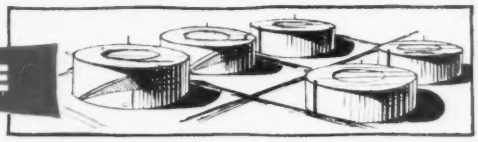

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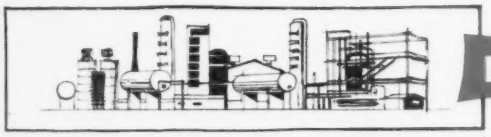

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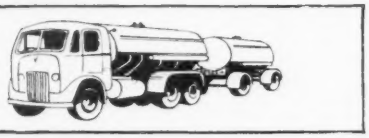

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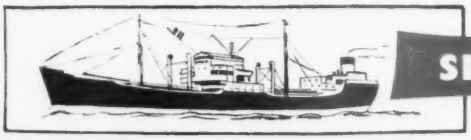

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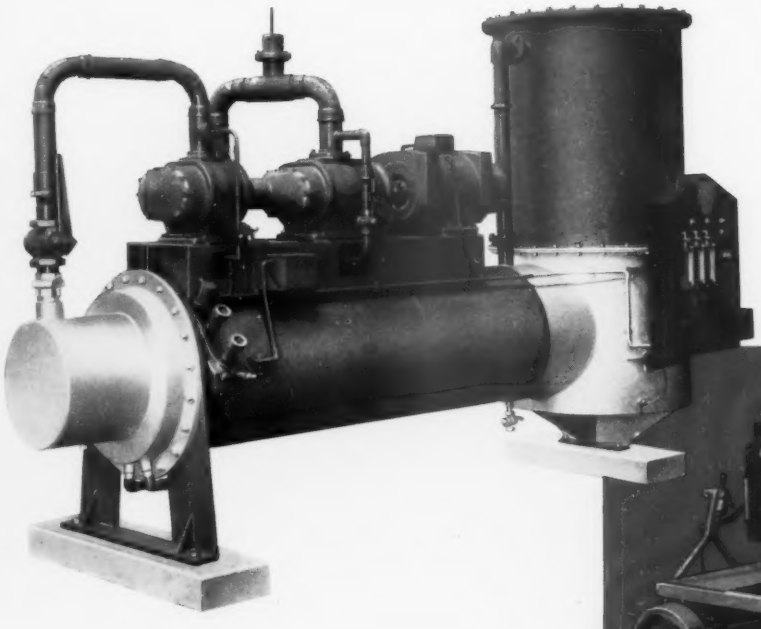

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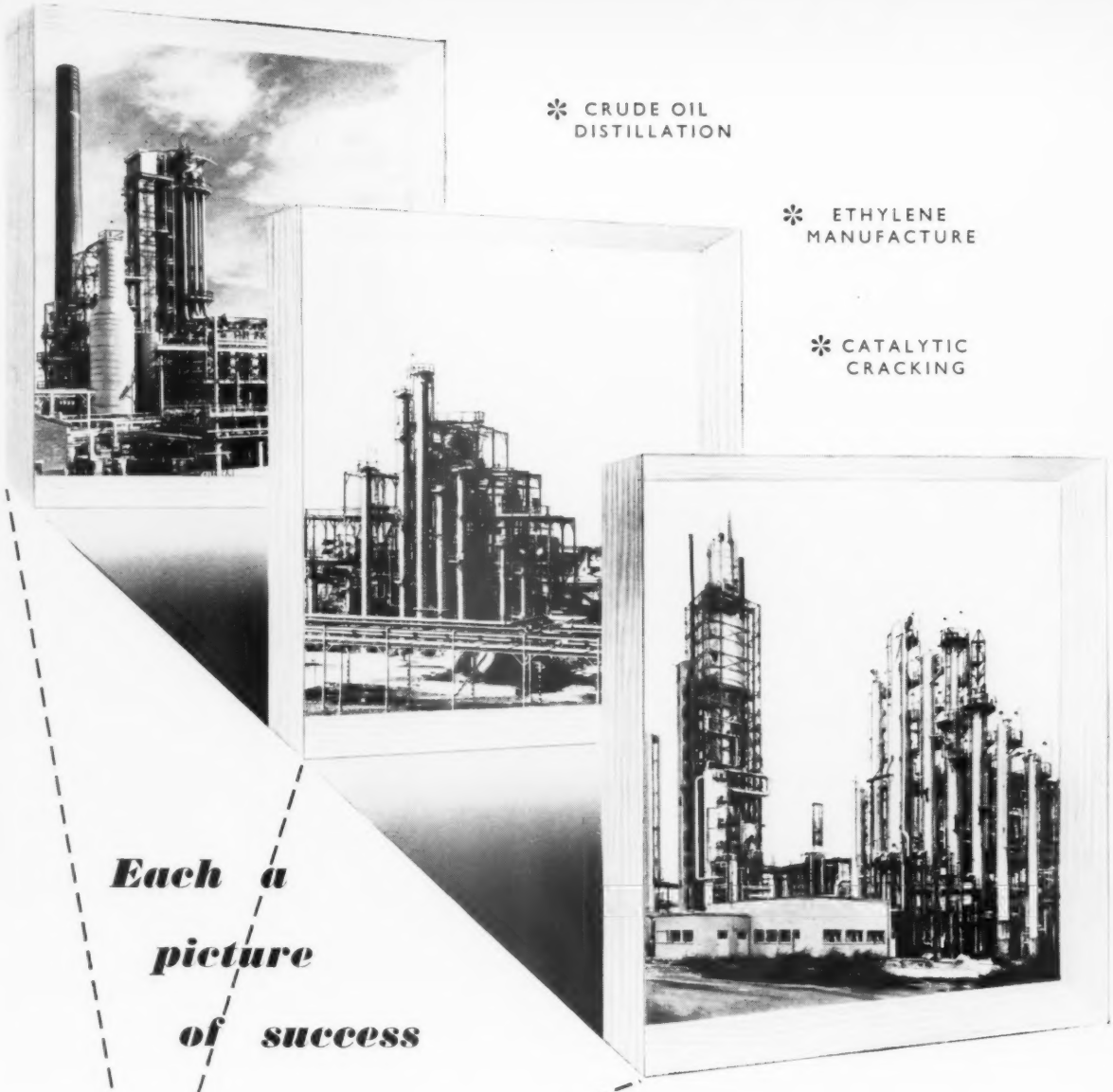

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